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VARIATIONS IN A COPEPOD CRUSTACEAN.

BY CARL F. GISSLER, PH.D.

IN March, 1878, a large, deep pond near Glendale, Long Island, was found densely populated with blood red Copepod Crustaceans, which, microscopically examined, proved to be a form slightly aberrant from *Diaptomus sanguineus*, described by Professor S. A. Forbes,[1] who figured its inferior and superior maxilliped and fifth pair of legs of the male and female.

The Long Island form[2] is unquestionably the same species as that from Illinois, but the climate and locality have effected slight morphological changes of those organs which in Copepod Crustaceans are most liable to occur. The differences noted between the individuals from the two localities are, however, very trifling, and its elevation to the rank of a new species would not be advisable. It appears, as in so many other instances, that careful examinations of a species from different localities do not demonstrate the constancy, but the evolution of the same. The changes sometimes concern insignificant structures, but often also the most important parts used by the systematist in describing a species.

To make the study of Copepods[3] in general, better understood to the amateur, I have more thoroughly described and figured all their external structures.

The body of Copepoda is more or less distinctly segmented and

[1] Bulletin of the Illinois Museum of Natural History. No. 1. List of Crustaceans, with descriptions of new species, by S. A. Forbes, 1876.

[2] Measures $3^{mm.}$ in length.

[3] Consult also "Die freilebenden Copepoden," by Professor Dr. C. Claus. Leipzig, 1863, page 200.

distinguishable into regions, with two pairs of antennæ, the anterior pair much larger, either one or both of the latter often transformed into an auxiliary, prehensile, copulative organ. They possess neither a carapace nor a bivalve shell; but have three pairs of mouth-parts and five pairs of swimming feet. Females with external egg-sac.

Family of Calanidæ.—Body elongate, similar to that of Pontellidæ, anterior antennæ very long, usually of twenty-four to twenty-five joints. In the male sex the right, rarely the left antenna is transformed into a geniculating, prehensile organ. Posterior antennæ comparatively large, two-branched. Mandibulary palpus two-branched, similar to the posterior antennæ. Maxillæ with a large, manifold-lobed palpus. Maxillipeds powerfully developed. Fifth pair of legs large, either similar to the four preceding or alike in both sexes, or aberrant from those and dissimilar in the sexes; in the male a clasping organ to assist, together with the right antenna, in copulation. Heart present. Eyes highly developed, median and mobile. Male genital glands unpaired, female glands paired. Single median egg-sac of orbicular shape.

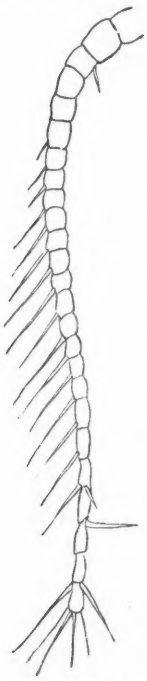

FIG. 1.—Left anterior antenna of male.

We now drop some live specimens into alcohol; they will die in a few seconds; leaving these crimson colored little Crustaceans in alcohol for some time, they will soon become pale and finally yellowish, transparent. We now pour off the alcohol and add a strong solution of pure carmine in concentrated ammonia and a little glycerine, macerating them for about one day. Then we wash the staining liquid gradually off, first with water and then with alcohol, and preserve them in glycerine for examination.

Placing a male specimen (Fig. 4) on a glass slide under the dissecting microscope with low power, we now proceed with the dissecting needles to separate successively the different appendages, viz., the anterior long antennæ, the shorter posterior antennæ, the mandibles with palpus, the superior maxillipeds, the maxillæ, the inferior maxillipeds, the four pairs of natatory legs, the fifth, trans-

formed pair of legs, and finally the abdomen with the terminal furca. Viewing the remaining "carcass" from which those appendages have been taken, we will notice that there is a certain demarcation between head and thorax, forming a segment; following this we find five more thoracic segments, of which the fifth is half as long as either the second or third, the fourth slightly shorter than the second or third, which latter two are equally long, the first being somewhat longer.

In the female the first and fourth thoracic segments are longer than the second and third, the fifth is faintly sub-segmented on the dorsal side, laterally terminating in a strong spine similar to *Ichthyophorba denticornis* Claus (Opus citatum, p. 199, Tab. XXXV, Fig. 1).

We now place the glass slide under a compound microscope, applying a low magnifying power and inspect the left, normally shaped, anterior antenna (see Fig. 1).

It is beset with pretty large bristles, and consists of twenty-five joints. When connected with the body, the fifteenth joint will reach to the base of the abdomen, and the terminal bristles reach to near the tip of the furcal bristles. The anterior antennæ originate from the first pair of larval legs, and are the means with which the Diaptomus performs its peculiar jerking motions, described by Herrick in AMERICAN NATURALIST, 1879, page 622.

In glancing at the right antenna of the male (see Fig. 2) one would think it had been taken from an entirely different species—so dissimilar it looks! If we count the joints, we find but twenty-three, two joints less than in the left antenna. But either the tenth or twelfth joint must consist of two connate joints, and the twenty-first is evidently also sub-segmented, making in all, twenty-five joints. The sixteenth to the nineteenth joints, inclusive, are considerably dilated and swollen, enclosing a powerful muscle, inserted near the fifteenth and in the twentieth joint; thence follows the knee-shaped section of the antenna, the geniculating part, consisting of a larger joint with an inner duplicature or

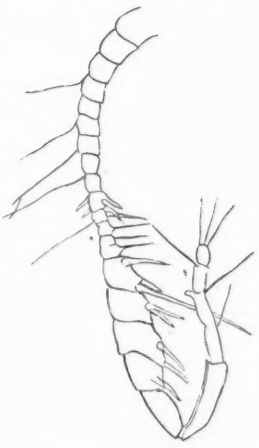

FIG. 2.—Right anterior antenna of male.

bead, forming a tier (originally several connate segments), and another larger, semi-segmented joint with a terminal, inner, bent-backward hook, and finally two smaller terminal joints. The dilated joints as well as some of the narrower preceding joints, are armed with powerful spines, and others with bristles. If this swollen right antenna be separated from a live male, it will twist around with snake-like motions for several minutes.

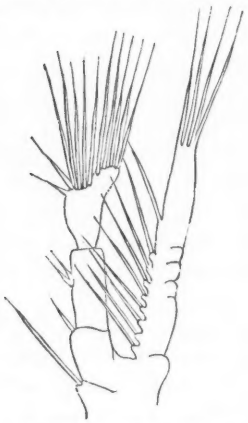

FIG. 3.—Posterior or second antenna. Main branch shorter.

As the external structures, with the exception of the fifth thoracic segment, the anterior antennæ, the fifth pair of legs and the abdomen, are alike in both sexes, we may proceed to the posterior or second pair of antennæ (see Fig. 3).

The posterior antennæ originate from the second pair of larval legs and have like those two branches. They are destined for locomotion, and also for respiration. The main branch is slightly shorter than the secondary branch.

Having once with certainty recognized the mandible (Fig. 4), then, after applying higher powers (about 500 ×), we are enabled to see the following characters: The tip of the first (outer) tooth is bent and has a very minute excavation. There are eight mandibular teeth. The second tooth is larger than any of the remaining six of the series, its suddenly contracted tip somewhat bent like the first tooth; it is separated from the third by an interval equal to the width of the tooth. A short stiff bristle appears at the lower end of the row of teeth. The secondary appendage of the mandibular palpus is four-jointed and bears six delicate bristles at its tip and inner margin. The larger, bent-upward bristle near the inner

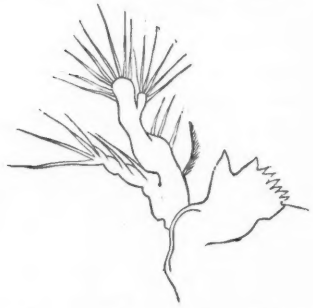

FIG. 4.—Mandible and mandibulary palpus. Enlarged about 300 ×.

base of the main mandibulary palpus is delicately bristled exteriorly only. Three smaller ciliæ are found above the latter on a small protuberance.

The mandible in all Copepoda originates from the third larval leg, which is already in the "Nauplius stage," provided with a dentate mandibular process. In the family of Calanidæ, the mandibulary palpus is comparatively longer than in the other five families of Copepoda.

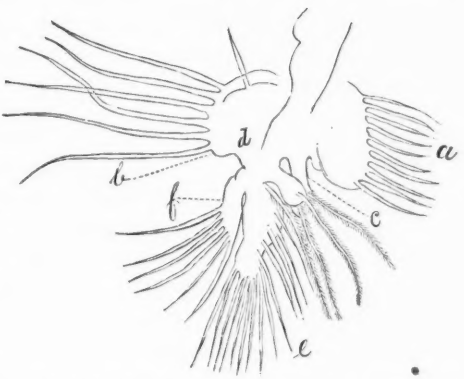

FIG. 5.—Maxilla. *a*, maxilla proper; *b*, basal broad lobe; *c* and *d*, two cylindrical basal processes; *e*, terminal palpus; *f*, posterior lobe, or secondary branch of palpus. Enlarged about 300 ×.

The maxilla (Fig. 5) is quite a complicated structure, consisting of several lobes, the explanation of which is found below the cut. The maxillæ are the second pair of oral organs, and originate from the bristled and lobed appendages of the larva, and these occur behind the third natatory leg, or future mandibulary palpus.

Another minute mouth-piece is the superior or first maxilliped (Fig. 6). It is somewhat sub-jointed, elongate, and bears fifteen bristles as the illustration shows. Both the superior and inferior maxillipeds are the separately diverging branches of a single pair of limbs originating out of the fifth pair of legs of the later "Nauplius stage," and are in the adult, with a few exceptions, dissimilarly inserted, the outer branches of those legs being transformed into the superior, the inner branches into the inferior maxillipeds.

FIG. 6.—Superior or first maxilliped. Enlarged about 400 ×.

We now take a look at Fig. 7, representing the inferior or second maxilliped. Its basal segment presents in our species four rounded processes on

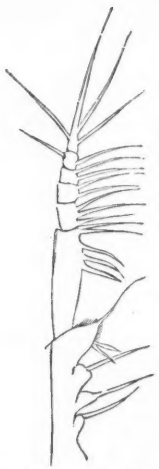

FIG. 7.— Inferior or second maxilliped.

its inner margin, the three first of which gradually become larger from base upwards, and bear each, one invaginate spine, the fourth is slightly produced inferiorly (the rounded tip being finely ciliate down to the produced lower middle), there (at the lower middle) bearing two spines directed downward, and a very fine long flagellum at its tip. The arrangement of the bristles of the last two joints, as well as the general outline of the whole, differ from *Diaptomus sanguineus* F.

The inner branch of the first of the four pairs of natatory legs has two, the rest three joints (see Fig. 8). Their purpose is aëration of the blood as well as locomotion.

The fifth pair of legs in the female is biramose, both branches arise from a two-jointed basal piece (coxa and trochanter), the inner branch is short, straight, slender, not jointed, abruptly terminating in a conical tip surrounded with microscopically small spines around a longer median one; at the side of the tip and opposing each other are two longer, movable (?) spines. The outer branch arises from the second broad basal joint, and is strong, two-jointed, terminating in a single, interiorly (near the tip) fine serrate claw, which has exteriorly two (one longer and one shorter) diverging spines a little above its middle (Fig. 9).

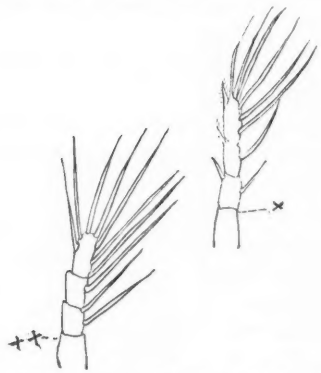

FIG. 8.—Form of second, third and fourth natatory legs. xx, inner branch; x, outer branch.

The office performed by the transformed fifth pair of legs in female individuals is not sufficiently known. They may be for the protection of the egg-sac or for properly placing the same, or perhaps they coöperate with the male in copulation. In some cases they may burst or pierce the spermatophores fastened below the female genital pore.

The fifth pair of legs in the male (Fig. 10) are very dissimilar. They both arise from a quadrate coxal joint; the left leg consists

FIG. 9.—Fifth pair of legs of the female. *a*, inner, and *b*, outer branch.

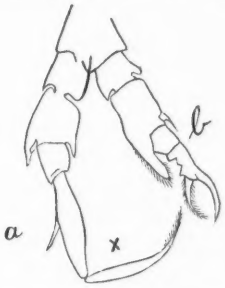

FIG. 10.—Fifth pair of legs of the male. *a*, right, and *b*, left leg.

of four joints, the first joint is quadrate and about one-third wider than long, slightly enlarging distally. The second joint is somewhat enlarged distally, about twice as large as the preceding joint, and bears a strong, wedge-shaped, blunt and finely serrate spine at the inner, and a shorter, slender one at the outer inferior angle. The third joint is clavate and distally tapering. The fourth joint is composed of an anteriorly notched, narrow basal piece exteriorly terminating with an incurved dactyl. The joint is from base to tip of dactyl, about two and a half times longer than the preceding joint; it terminates interiorly with another dactyl, nearly as long as the other; is finely serrate on both sides and acts in closing as a forceps. The right leg consists of five joints, the basal and the second joints are quadrate, the latter enlarges distally and bears a smaller blunt spine at the inner, and a larger one at the outer angle. The third joint is subquadrate, slightly tapering distally, the fourth joint is clavate, bearing a slender spine at the middle of its outer margin, and the fifth constitutes a slender incurved dactyl as long as the preceding joint, finely rugose on the distal half of its inner margin, and is so jointed as to close back against the inner margin of the fourth joint, which thus acts as a hand. The left leg (in Fig. 10, *b*, purposely drawn larger) reaches only about to the tip of the third joint of the right leg.

In the family of Calanidæ, in general, the abdominal segments are considerably narrower in the male than in the female, the former consisting of five, the latter of four segments. The first of

the five male abdominal segments is as long as the fifth, and is the broadest, its anterior ventral angle is prominent, the second joint is twice as long as the preceding, the third and fourth gradually shorter. Furca, from base to tip of bristles, longer than the first, second and third segments together.

The first of the four female abdominal segments bears ventrally an opening on a circular elevation (in Fig. 11, seen from the side), the female genital orifice, to which the secretion of a gluey mass, the product of two large orbicular cement glands, situated on the segmentation line between the fifth and sixth thoracic segments, flows. Mounted specimens plainly show the two ducts of the glands running down to the orifice in the first abdominal segment. The two ovarial lobes begin with broad rounded bases in the second thoracic segment, and gradually taper downward. Although I was unable to find the oviduct entering the first abdominal segment, it is evident, from the position of the egg-sac that the products of the cement gland and ovary have one and the same exit. A *receptaculum seminis* is wanting.

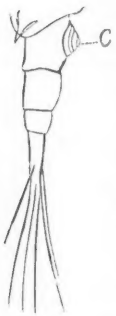

FIG. 11. — Side view of the four abdominal segments of the female. *c*, abdominal pore or genital orifice.

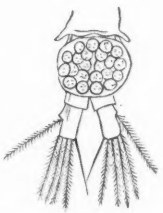

FIG. 13. — Front view of last thoracic segment below which, on the abdomen, is seen an egg-sac and the furca (the latter drawn larger in comparison with the rest).

The second segment is a little shorter than the first, the third is about half as long, the fourth is still shorter and bears the furca (Fig. 13), with orbicular egg-sac. From thirty to forty eggs are contained in a sac.

The spermatophores containing the fertilizing zoösperms are glued by the fifth pair of legs of the male to the female genital orifice during copulation. I noticed from one to four spermatophores on some females (Fig. 12).

The inaugural dissertation of Dr. Aug. Gruber, "Ueber zwei Süsswasser-Calaniden," Leipzig, 1878, pp. 34, two plates, gives us the latest knowledge concerning the formation and action of the spermatophores, and as this special work may not be in the hands of every American carcinologist, and owing to the complexity of the matter itself, an abstract of the same, I trust, will be welcome.

In the male the *vas deferens* can be distinguished into three distinct sections, each of them performing a different function. The glandular cells of the walls of the first section secrete a viscid, gluey substance, a sort of cement into which, coming from the testis and passing through the posterior terminus of the *vas deferens*, the elongate (in Diaptomus) zoösperms enter, forming a long narrow string. The diameter of the first section is nearly of equal width in its entire length. The second section is more dilated anteriorly, rounded and tapering posteriorly. Here we find a central, voluminously swelled mass, the above mentioned homogeneous glue-mass, peripherically surrounded with a layer of densely packed zoösperms, which but loosely fit into innumerable roundish lodges or hives, the latter constituting the interior of the partly perfected exterior spermatophore capsule. The formation of the latter began probably already in the first section, since the two sections do not functionally differ from each other. This still imperfect spermatophore enters immediately into the third and last section of the *vas deferens* as soon as the last perfect one has just left the male genital orifice.

FIG. 12. — Front view of right angle of the last thoracic segment of female and part of the first abdominal segment with two spermatophores, *c*, one is partly and the other entirely empty.

FIG. 14.—A male *Diaptomus sanguineus* var., enlarged about 8 times. Side view.

A number of zoösperms in the posterior rounded terminus of the spermatophore act as abortive or expelling factors, becoming first granulated toward the perfection of the spermatophore, and, through the endosmotic absorption of water, several of them coalesce with a number of cellular vesicles like soap-bubbles (polygonal in Diaptomus). The expelling cells gradually swell, pressing the central glue-mass into the middle of the spermatophore, and first become nucleate and then plain. Through the further increase of these expelling cells, the central glue-mass is more and more compressed and slowly moves toward and out of the narrow terminus of the spermatophore, and in oozing out forms a saussage-like body, by means of which, in copulation, the spermatophore is glued beneath the valvule of the female genital orifice. Into the center of this mass follows the remainder of the zoösperms, the latter being perfectly surrounded by the former, forming a

minute ball. The glue-mass, according to Dr. Gruber, evidently yields also the material for the formation of the egg-sac, since, firstly, in oozing out of the valvule the eggs are driven into the mass, and secondly, the egg-sac is not formed before the act of sexual union.

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SCOLOPENDRELLA AND ITS POSITION IN NATURE.

BY A. S. PACKARD, JR.

THE recent notices by Mr. John A. Ryder, particularly his last able paper,[1] have called fresh attention to this interesting creature, and his discovery of two species in addition to the one originally noticed by the writer, shows that the United States are as much favored as Europe in specific forms. Scolopendrella is a small, whitish tracheate animal, not exceeding a quarter of an inch in length, with a superficial resemblance to a myriopod, such as Scolopendra, having a pair of well developed, five-jointed legs to each abdominal as well as thoracic segment; its name ending in a diminutive gives evidence of the original opinion of its discoverer, that it was a small myriopod, like Scolopendra, the centipede. In deference to the general opinion of naturalists in our "Guide to the Study of Insects," and our "Zoölogy" we have let it remain among the Myriopods, but it occupied an uncertain place, as we waited for more light upon the subject of its affinities, and for time to study it with more care.

Attention was first called to the existence of this type of Tracheates in the New World by a brief notice which appeared in the Proceedings of the Boston Society of Natural History, Vol. XVI, p. 111, 1873, which read as follows:

"For nearly two years we have had in the Museum of the Peabody Academy of Science a specimen of Scolopendrella, detected September 8, by Mr. C. A. Walker, under a board in the grounds of the museum. It is nearly related to *Scolopendrella immaculata* Newport, and if new may be called *S. americana.* Of the remarkable features in the structure of this animal I do not now propose to speak. It has, however, in the head and antennæ a strong re-

[1] The structure, affinities and species of Scolopendrella, Proc. Acad. Nat. Sc. Phil., 1881, p. 79.

semblance to Campodea, and in this and in the presence of spines at the base of the legs, and in other characters, it bears a striking similarity to the Campodeæ and the Thysanura, as already indicated by Lubbock. It may be regarded as a connecting link between the Thysanura and Myriapoda, and shows the intimate relation of the Myriapods and the Hexapods, perhaps not sufficiently appreciated by many zoölogists."

It will thus be seen that eight years ago we called attention to the strongly marked Thysanurous features of Scolopendrella, a fact apparently overlooked by Mr. Ryder, who quotes at length, however, the opinion of Menge in 1851, who, therefore, was the first to call attention at some length in an able paper, to the structure of Scolopendrella, of which Mr. Ryder gives a useful abstract.

Up to last year Scolopendrella had been left undisturbed in its niche among the Myriopoda, when in 1880, in this journal,[1] Mr. Ryder boldly suggested that it should be regarded as the type of a distinct order of articulates, and called attention anew to its close relationship to the Thysanura; and in his last paper gives the characters of the order, and a list of the known species, with descriptions of a new one, under the name *Scolopendrella gratiæ*. He also figures a form very closely allied to, if not identical with *S. notacantha* of Europe.

Having collected considerable material, notes and drawings for a monographic account of our Thysanura, and having worked out the external structure of Campodea and Lepisma, we have long been anxious to study with care the structure of Scolopendrella. A species occurred at Salem, Massachusetts, which we called provisionally *S. americana*, deferring a description of it until we could get from Europe specimens of Newport's *S. immaculata*. Writing for several years past without success to naturalists in England, Belgium and Denmark, during the past spring we had the good fortune to receive several specimens of this species from Bohemia, through the kindness of Dr. Latzel, author of a work on Austrio-Bohemian myriopods, which we have not, however, seen.

I afterwards, in 1874, found two specimens of my Salem form under stones at the mouth of a small cave (White's cave, Jr.) near Mammoth cave, and the same spring Mr. Sanborn collected one in a cave near Dismal creek, near Mammoth cave.

[1] Scolopendrella as the type of a new order of Articulates (Symphyla), AMERICAN NATURALIST, May, 1880.

On comparing them with seven well preserved specimens from Bohemia, I find no difference, except that our form has rather longer and slenderer antennæ than any of the Bohemian specimens; the American cave individuals have uniformly thirty-three joints, and the spaces between the nodes are longer than in the Bohemian ones, which have from twenty-one to thirty-two joints. We do not, however, regard this as a specific character in so variable a genus as this, and it may be that out-of-door forms may occur in this country with shorter and stouter antennæ, like the European one. We regard, then, our *S. americana* (no description published) as a synonym of *S. immaculata* Newport.

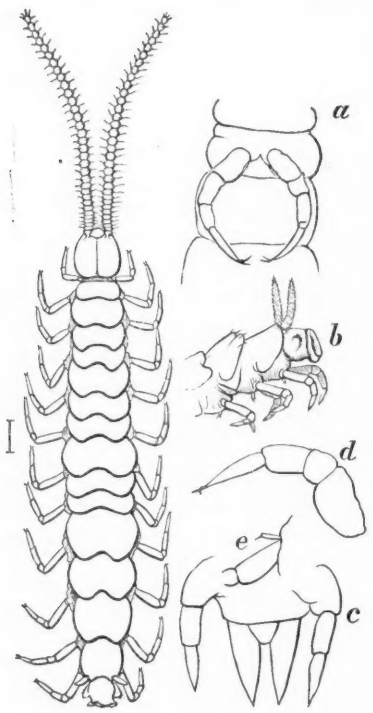

FIG. 1.—*Scolopendrella immaculata* highly magnified; *a*, second thoracic segment with legs; *b*, end of body, showing the caudal stylets; *d*, a leg, first joint not shown; *c*, end of the body, showing caudal stylets; *e*, base of leg with supplementary appendage. Emerton and Packard, del.

The adjoining figure, drawn by Mr. Emerton from the specimens from White's cave, Jr., with the details of the caudal appendages drawn with the camera from the Salem specimen, will represent this form, which is 5 mm. in length.

Let us now look at theThysanurous features of the Scolopendrella, and then compare it with the Myriopods, such as our common Lithobius.

The structure of the head is exactly as in Campodea, the form of the epicranium being the same, having a well marked median suture, while the posterior edge of the clypeus is angular, the apex of the triangular edge meeting the epicranial suture, as

in Campodea; the labrum is small and rounded in front (what Menge calls the labrum is in reality the clypeus). The mode of insertion of the antennæ and their shape is as in Campodea. The form of the clypeus and of the antennæ are entirely unlike those of any Myriopod known to us. The mouth-parts bear the same relation to the head, and are sunken or withdrawn into the head in the same peculiar manner, as according to Meinert and our own repeated observations, characterizes the Thysanura. The bases of the jaws and maxillæ are contained deep in the cavity of the head or epicranium, only the ends projecting out, as in Campodea.[1] The mandibles are slightly curved, toothed, and constructed on the Campodea type; the maxillæ are long and slender, and in a side view are seen through the walls of the thin epicranium, appearing much as in Campodea. Their structure is in general like that of Campodea.

The legs are five-jointed and, as observed by Menge and Ryder, end in two claws, as in Campodea; in Myriopods there are six joints, and always a single large claw. The stigmata we have found to open between and just behind the legs, as Mr. Ryder has stated, but we have been unable to find any in the first and second segments behind the head; those corresponding to the prothoracic and mesothoracic segments of hexapodous insects.

The v-shaped opening, supposed to be either sexual or to correspond to the sucking organ of Thysanura, we have observed only in the fourth segment, or that corresponding to the first abdominal segment of Thysanura and insects in general. We are disposed to regard this as the homologue of the sucker of

[1] Meinert (Annals and Mag. Nat. Hist. 1867, p. 362), ascribes great importance to the "position of the first two pairs of appendages of the mouth with reference to the skull." In most insects, and in the Myriopods, the jaws for example act transversely and articulate with the epicranium by means of a hinge-joint. In the Thysanura the bases of the mandibles and maxillæ are retracted within the cavity of the epicranium, and are buried in muscles, while generally only their points project outside of their mouth. This is the case with Thysanura, both in Campodea and allies (our sub-order Cinura), and in the Poduræ, or Collembola, but in the highest Thysanura, Lepisma, the jaws are external and articulated to the skull outside of the mouth, and thus Lepisma approaches the true hexapod insects, and affords a passage from one type of head to the other. Scolopendrella, with its feeble jaws and maxillæ buried in the mouth and enveloped in muscles, is throughout Campodea-like, and essentially unlike the Myriopods, such as Lithobius and Scolopendra with their large, powerful, biting jaws, hinged to the thick, solid epicranium and acting transversely.

Poduræ, and which we have designated as the collophore; the occurrence of this opening on the fourth ring indicates that in Scolopendrella we may distinguish between a series of three thoracic segments and about nine or ten abdominal segments.

Now examining the supposed myriopodous features of Scolopendrella, we find that they consist in the identity in form of all the body segments behind the head, and in the fact that each segment bears a pair of functional several-jointed legs. In Machilis, however, the thoracic segments grade almost imperceptibly into the abdominal arthromeres or somites; though in Lepisma, and especially in Japyx and Campodea the thoracic segments are clearly differentiated from the abdomen.

Now the possession of functional jointed abdominal legs by Scolopendrella does not imply that it is necessarily a Myriopod; we have seen that the feet differ in important respects from those of the centipede, and the presence or absence of abdominal feet is not an ordinal or very important character, for the head characters are both in Hexapods as well as in Arachnida and Myriopods, of the most importance in separating orders and subclasses. Turning now to the Thysanura, we see that Campodea has a series of one-jointed abdominal appendages which are, as we have observed, very movable while the insect is running. They appear to be rudimentary locomotive appendages. Those of Machilis are much better developed and are still more leg-like; the two pairs of terminal shorter stylets of Lepisma we have observed are used as prop-legs, so that the transition from the legs of Machilis to Scolopendrella is not a very abrupt one. We therefore conclude that the sum of the characters of Scolopendrella are Thysanurous, and that the homogeneity of the body segments and the five-jointed legs which has led to their being regarded as Myriopods, have misled naturalists; Scolopendrella seems to us to be only analogous to the Myriopods as regards its feet. The presence of the two caudal stylets is also a Thysanurous feature; these organs we should regard as homologous with the stylets of Lepisma and the forceps of Japyx. Menge and Ryder regard them as spinning organs, and we would agree with this opinion, as in one of the specimens from Bohemia, we could see the ducts leading into each stylet, from one of which a silken thread projected. From Menge's statement that the opening of the oviduct lies immediately above the anus, we should dissent on general grounds, as

in no known arthropod is this the case. Although we have not been able to find the opening, it should be looked for between the second and third segments from the anus.

The view of Menge and of Ryder that "these singular animals should be separated from the myriopods proper," will, it seems to us, be concurred in by any one who may carefully examine into the matter.

Now arises the question as to the real position of the Scolopendrella. Mr. Ryder gives the following results of his able investigations:

"This form as interpreted above, becomes of the highest interest to the zoölogist, and if the writer is not mistaken, the biunguiculate legs and their nearly complete correspondence in number with the rudimentary abdominal and functional thoracic limbs of the Thysanura, especially Machilis and Lepisma, which also have basal appendages to the legs, indicate as much affinity with insects as with myriopods, and may indeed be looked upon, perhaps, as representing the last survival of the form from which insects may be supposed to have descended. I name the new group *Symphyla*, in reference to the singular combination of myriopodous, insectean and Thysanurous characters which it presents." He regards the Symphyla as an order with one family, the *Scolopendrellidæ* of Newport. We had been ready to adopt this order, though we felt uncertain as to its position; but on a re-examination of the structure of *S. immaculata*, and from the information afforded by Menge and Ryder, have been led to question whether the Symphyla should be regarded as an independent order of Tracheata, and if so, whether they should be included with the Thysanura among the genuine insects or not. We see no reason why the Thysanura should not be regarded as an order standing at the bottom of the hexapodous series, and constituting an eighth order of Hexapoda. We regard the *Collembola* of Lubbock as a suborder of Thysanura; we have in the seventh edition of our "Guide to the study of Insects," 1880, thrown the Lepismatidæ, Campodeæ and Japygidæ into a new suborder called *Cinura*. Now the question arises, have the *Symphyla* characters sufficiently distinctive to keep them apart as a separate order, next to and below the Thysanura as a whole, or should they be regarded as a third suborder of Thysanura equivalent to the *Collembola* on the one hand, and to the *Cinura* on the other? We are inclined to the latter view.

The distinctive Thysanurous character of the Symphyla, are the form of the head as a whole, that of the epicranium, and of the clypeus and the small labrum, as well as the mode of insertion of the antennæ, and their form. The mouth parts, *i. e.*, the mandibles, maxillæ and labium, have the essential form of Campodea; the caudal stylets are insectean. These characters do not remove them more than by one family from the Campodeæ and Japygidæ. They also have what is possibly a collophore; the spiracles are much as in Japyx, but situated between the legs, though the presence or absence of spiracles is so variable in the Thysanura as to be unimportant. The differential characters are the presence of five-jointed functional legs, and the dorsal scutes of the somites, the latter homonomous; but even here the claws are exactly as in Campodea, and we see an approach to the multiarticulate legs in Machilis, and the two pairs of long proplegs in Lepisma. Under these circumstances we should include the Symphyla as a suborder of Thysanura. At the same time we wish to bear testimony to the ability and good judgment shown by Mr. Ryder in dealing with a most difficult problem, and offer our own views for the consideration of zoölogists. None the less as pointed out by Mr. Ryder, is the view (we have also long held) well founded, that Scolopendrella is an ancestral, synthetic form. In this respect it stands side by side with the Campodea. The structure of this synthetic type also shows how close is the relationship between the hexapodous insects and the Myriopods, which are more closely related in most respects than the Hexapoda and Arachnida. We are also confirmed in the view that the Hexapods, Arachnids and Myriopods are too closely related to be regarded as independent classes, and should be regarded as subdivisions (subclasses) of Tracheata.

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AMERICAN WORK IN THE DEPARTMENT OF RECENT MOLLUSCA DURING THE YEAR 1880.

BY WILLIAM H. DALL.

SINCE the recorder prepared his last report on this subject (for 1879), Dr. James Lewis, of Mohawk, N. Y., well known for his researches into the natural history of land and fresh water shells of North America, has passed over to the majority. Fortunately the ranks of the working malacologists of America have

not sustained any other loss during the past year, though the death of Professor Haldeman recalls the excellent work done in that department by him, many years ago.

The recorder would particularly request from authors, early copies of any papers bearing on malacological topics,[1] in order that this record may, in future, be more promptly prepared. This is especially desirable when the article is published in any of the semi-scientific periodicals of small circulation and uncertain tenure of existence, which appear from time to time, fulfill a certain good purpose, but usually demonstrate their unfitness for serving as a medium of communication with the scientific world, by a pervasive eruption of advertisements in the text, a feverish craving for clippings and a rapid descent into an early grave.

The year has been marked by no extraordinary discoveries in the biology of mollusks, but a fair amount of creditable work has been done, of which, perhaps, a larger portion than usual is of a high character. Several investigations of great interest are in progress, but it has seemed best to confine the record to such as has been irrevocably placed before the scientific world by publication.

General Works.—Mr. Tryon's Manual of Conchology has progressed, during the year, to the first part of the third volume. Volume second contains the Muricinæ and Purpurinæ, comprising two hundred and ninety pages and four hundred and forty-two figures on seventy plates. Volume three, of which part one appeared in the last days of the year, is to contain the Tritonidæ, Fusidæ and Buccinidæ.

Anatomy, Physiology and Development.—The most valuable work in this department, in 1880 as in 1879, is due to the labors of Professor W. K. Brooks. "Studies from the Biological Laboratory of the Johns Hopkins University" (Vol. I, Part IV), contains a memoir on "The development of the American oyster, *Ostrea virginiana* List." (pp. 1–104, pl. I–X), which also appears in the Report of the Commissioners of Fisheries of Maryland for 1880; and an article on "The acquisition and loss of a Food Yolk in Molluscan eggs" (pp. 105–116, pl. XI). The researches on the oyster having been undertaken at the instigation of the Maryland Fish Commissioners, the first thirty-four pages of this memoir contain in untechnical, but quite sufficiently exact phrase-

[1] Which may be sent care of the Smithsonian Institution.

ology, a statement of the nature, method and extent of the observations and conclusions reached from them, with a few words of warning in relation to the inevitable ruin of the beds to follow excessive dredging; the laws relating to which, it may be noted—though Professor Brooks does not mention it—are practically ignored. He finds the average number of eggs in an oyster of ordinary size to be about nine million, against less than two million reported for the European oyster; while some American oysters may furnish sixty million. In the European, however, the young are believed to be protected, during their most precarious stages, in the parent shell, so that perhaps $\frac{1}{4300}$ of them come to maturity, while our American species undergo their development in the open sea, subject to fatal changes of temperature and unnumbered enemies, which must greatly diminish the proportion of survivors. The sex of individuals during the breeding season, contrary to the oystermen's opinion, cannot be distinguished without dissection, and they appear, for the time being at least, to be singly male or female only, and never hermaphrodite.

The second part of the paper discusses some of the more abstruse topics connected with the subject, and is written more for the embryologist, as the former part is for the general reader. Among the conclusions arrived at, are the singleness of sex in the individual; that the impregnation is external to the shell; that the segmentation is remarkable for its rapidity; its bilateral symmetry and marked alternation of periods of rest and periods of repose; both regular and rarely-recurring irregular processes of segmentation are described, and the conclusion is reached that the process of Lamellibranchiate segmentation is a survival from ancestral conditions which included few large eggs provided with food-yolks, these last having been lost as the eggs became smaller and more numerous, while the mode of segmentation has been retained perfectly by the oyster and incompletely by other Lamellibranchs. The evidence appears to the author to strengthen his previously expressed opinion that the Lamellibranchs must be regarded as a side branch from a main stem, of which the Gasteropods are a much more direct continuation, and that the phylogeny of the higher Mollusca cannot be traced through the Lamellibranchs to lower invertebrate forms. Of these views, the second paper on the acquisition and loss of a food-yolk (with a

comparative plate of embryo forms) is chiefly an amplification. The first memoir concludes with a discussion on the formation of the digestive tract, the shell and the mantle, and the relation of the facts observed to the Gastræa theory.

Apropos of the American oyster, a letter dated Gibraltar, June 14, 1880, from Mr. Francis Winslow, U.S.N., to Professor W. K. Brooks, appears in the January NATURALIST of the present year (p. 57), giving an account of an attempt made to fertilize some Cadiz oysters, and the unexpected agreement, so far as the observer was able to determine, of the development with that of the American form. Mr. Winslow says: "So far as these results go, they prove that the artificial propagation of the European oyster is practicable to just the same extent as our own, and I think it throws grave doubts on the theory that the embryo is protected within the shell, and that the impregnation occurs there and nowhere else."

The reporter in examining the exhibition of oysters at the Paris Exposition in 1878, saw shells of a species of oyster in the collections which was referred to as the "Portuguese" oyster, and which he could not distinguish from the shells of *O. virginiana*. These Portuguese oysters are regarded with contempt by the French oyster-cultivators, who advertise, as a merit, that their particular parks are free from contamination by this objectionable variety. They are said to be free from the coppery flavor of *O. edulis*, and to be larger and tougher—just the qualities ascribed to American oysters by those who are accustomed to the *O. edulis*. The observations on the embryology of the European oyster were all made on the *O. edulis*. If, therefore, these Cadiz native oysters were (as may be suspected) the "Portuguese" oysters of the French, and identical (as seems not impossible) with *O. virginiana*, the discrepancy would be explained without throwing discredit on the researches of those European naturalists who have examined the other species. Mr. Winslow, under the direction of the U. S. Coast Survey, made some very meritorious surveys of a part of the Chesapeake oyster beds in 1879. His report was published in the Report of the Maryland Fish Commission for 1880, by permission of the Superintendent of the Coast Survey; and its value, as we are informed, has since been recognized by the French Société d'Acclimatation, which has awarded a bronze medal to the author.

In the September NATURALIST (p. 674), Mr. J. A. Ryder describes the course of the intestine in *Ostrea virginiana*, which he found to have but one complete turn upon itself, and in the course of its (dorsal) flexure, to pass almost directly over the mouth, and to be provided with a pair of internal longitudinal folds.

Brooks in the *American Journal of Science* (Oct., 1880, p. 288) has a short article on the homology of the Cephalopod siphon and arms, in which he concludes that they are neither homologous with the velum nor the foot, but are independent developments.

In the Anniversary Memoirs of the Boston Society of Natural History (1880), Brooks contributes a paper on the "Development of the Squid (*Loligo pealii* Lesueur)," containing twenty-two pages and three plates. In this article he observes that while the squid embryo fails to give us any information as to how a typical mollusk has been modified to convert it into a Cephalopod, or the transformations undergone during the process, it nevertheless clearly shows the fundamental similarity of type which subsists between it and other Mollusca.

In last year's record allusion was made to Professor Verrill's "Cephalopods of the north-eastern coast of North America," Part I of which, including the gigantic squids and their allies, has since appeared in the Transactions Connecticut Academy of Sciences, V, pp. 178–257, with fourteen plates. Much of the material in this paper has been the subject of preliminary notices; *Stenoteuthis* n. g. for *Architeuthis megaptera* Verrill, and a large Bermudan squid, perhaps *Om. pteropus* Stp.; and *Lestoteuthis* for *A. kamschatica* Midd., from the North Pacific, are the only absolutely new names proposed here, but a large array of new facts, a thorough digestion of previous literature, a revision of the genera and a satisfactory illustration of the several species as far as known, give to the paper a monographic character. The principal among the species treated of and figured, are *Architeuthis harveyi*, *hartingii* and *princeps*, *Stenoteuthis megaptera*, *Histioteuthis collinsii* and *Enoploteuthis hartingii*, all of Verrill; *Architeuthis dux* and *monachus* of Steenstrup; and *Onychoteuthis robusta* Dall, the last being from the Aleutian islands. The paper will form the standard of reference for this interesting subject.

A synopsis of a lecture, by Professor A. Hyatt, given before the American Association, appears in the NATURALIST for December (p. 915–6); the subject being the transformation of *Planorbis*, as a practical illustration of the evolution of species. Although based on the study of the fossil forms of Steinheim, it is referred to here on account of its obvious bearing on the general subject.

A fully illustrated memoir on this subject is contained in the memorial volume of the Boston Society of Natural History.

In the NATURALIST (March, 1880), p. 207, Mr. R. Ellsworth Call has a note on reversed specimens of *Melantho* (*Campeloma*), and an examination of embryonic shells of several species, showing that from fifteen to twenty-five reversed specimens were found in every thousand, of which, however, it is believed by Mr. Call, only one-tenth per cent. survive to maturity. He suggests that the reversals may be due, as some other irregularities are, to crowding in the ovarian sac.

A circular has been issued by Messrs. R. E. Call and A. F. Gray, asking the coöperation of conchologists in providing material for a proposed monograph of the *Unionidæ* of North America, in which they propose to figure the anatomy of each species in detail.

The polymorphous forms of *Anodonta* found in the United States, are referred to in a note by Professor Call in the NATURALIST for July, p. 529. The existence, everywhere about us, of transition forms of animals, is now being generally recognized by naturalists, who formerly, under the blinding influence of the dogma of fixity in specific characters, wandered hopelessly from the extreme of naming every individual variation, to that of confounding every sort of minor characteristic under one specific name. Now that a certain amount of freedom in these matters has become habitual, we may look for the speedy recognition of the particular effects produced by at least the more simple features of the environment, of which several of our Western naturalists have already given us a foretaste.

In the AMERICAN NATURALIST for July (p. 522), R. Bunker notes that a specimen of *Lymnæa elodes* Say, from which a piece of shell the size of a half dime had been broken out, showed signs of reparation in three days, and in six weeks the injury was completely repaired, the mollusk meanwhile performing its usual functions in an aquarium.

In the AMERICAN NATURALIST for March (p. 214), Mr. Lockwood notes a case of extreme vitality in a specimen of *Helix aspera (aspersa?)*, which lived thirteen months without food.

Geographical and Bathymetrical Distribution and Catalogues.— A valuable contribution to our knowledge of the geographical distribution of invertebrates on the north-west coast of America, is made by Mr. J. F. Whiteaves in the "Report of progress of the Geological Survey of Canada, 1878–9," pp. 190 B—205 B, Montreal, May 1, 1880; his paper being entitled "On some Marine Invertebrata from the Queen Charlotte islands." It is based on collections made by Dr. G. M. and Mr. Rankine Dawson in the summer of 1878, on the eastern and northern coasts of the group. *Macoma carlottensis* Whiteaves, a species much resembling *M. iridescens* Sby., and *Lepton rude* (Dall MS.) are described and illustrated by good woodcuts. Many species in the list have hitherto been known only from more southern localities. The depth and exact locality are precisely indicated; the mollusk fauna, as might be expected, is distinctively Oregonian in character. Several new species of Echinoderms are described by Professor Verrill, and two species of corals, a *Balanophyllia* and *Paracyathus* are noted, the latter of which was only previously known from Monterey, Cal.

In the Proceedings of the Philadelphia Academy for the current year (pp. 40–127, pls. 1–8, IX–XVI), Dr. R. Bergh, of Copenhagen, concludes his memoir on the Nudibranchiate Gasteropod Mollusca of the North Pacific ocean, with special reference to those of Alaska. This, with Part I, noticed in our last report, completes the revision of the species known to exist in that region, and is, without doubt, the most important contribution to the subject ever published in America. Too crowded with anatomical and other details to admit of intelligible condensation in the form of an abstract, it may be mentioned that the species described by Cooper and others are here for the first time referred to their true systematic relations, and enumerated under their proper genera. Several European species are recognized, and others are represented by closely allied forms, nearly all are subjected to minute microscopic dissection and appropriately figured in detail from camera lucida drawings. The new species described in the second part, are *Akiodoris lutescens*, Aleutian islands; *Lamellidoris* (var.) *pacifica*, Bering sea; *L. varians*, Aleutians,

and a variety of it; *L. hystricina*, same locality; *Adalaria pacifica* and *A. virescens*, Unalashka; *Acanthodoris cærulescens*, Bering sea; *Themisto (Palio) pallida*, Aleutians; and *Triopha modesta*, Shumagin islands, Alaska. For the last (at first referred to *Triopa*) the genus *Triopha* is proposed, and *Colga* is suggested for the group typified by *Doris lacera* Abildgaard (l. c. p. 112).

Brooks (Proc. B. S. Nat. Hist. xx, pp. 325–9) contributes a paper on "The development of the digestive tract in Mollusks," in which he records his views of the leading points in the develment of pulmonates and of the oyster from the observations given in detail in the subsequently published memoirs on the fresh-water Pulmonates and on the oyster, elsewhere referred to.

In the Annals of the N. Y. Academy of Sciences, I, No. 11, pp. 355–362, pl. XIV, XV, Mr. W. G. Binney continues his valuable investigations and notes on land shells of the United States, and on some exotic species. The following new species are described: *Macrocyclis hemphillii* (Olympia, Or.); *Zonites rugeli*; *Z. andrewsi*; and *Mesodon andrewsi*, from Roan mountain, N. C., collected by Mrs. Andrews. Notes on the anatomy and dentition as well as the synonymy of species already known, make up the balance of the paper. The genus *Tebennophorus* is now first reported from the Amazon, three hundred miles inland from Para, Brazil.

In the Bull. Mus. Comp. Zoölogy (VI, No. 3, Feb., 1880) the fifth report on the *Blake* dredgings in the Gulf of Mexico, comprises "General conclusions from a preliminary examination of the Mollusca," by W. H. Dall (pp. 85–93). The material considered embraced four hundred and sixty-two species of ninety-six genera (this term being liberally construed), ranging from a few fathoms to 1920 fathoms. A comparative table of the genera and number of species of the littoral and abyssal Gulf fauna is given, together with illustrations of the range of individual species, showing that many range from thirty fathoms to over eight hundred fathoms, a fact which had never been clearly indicated before, as most of the deep sea expeditions avoided carrying their investigations continuously from the abyssal into the littoral region. Pteropods and pelagic surface forms are not considered. The general conclusions are as follows: 1. The fact, already known, that certain species have a limited vertical range, forming respectively a littoral and an abyssal fauna, is supplemented by

the hitherto unrecognized fact that a fair proportion have a vertical range including both regions. II. Of the species with great vertical range, the smallest part (ten per cent.) belong to boreal or cold water forms; the next larger (twenty per cent.) to tropical or warm water groups, while more than sixty belong to groups not specially characteristic of the *littorale* of either region. III. Of the species found in the abyssal region, without regard to their range above it, ten per cent. may be termed boreal, thirteen per cent. tropical, and more than seventy-five per cent, uncharacteristic generic forms. IV. Since the tropical forms found belong to the same groups as the local littoral mollusk fauna, it is eminently probable that the abyssal regions have local faunæ proper to their various portions, and that a universal exclusive abyssal mollusk fauna does not exist. V. The specific characters of many of the strictly abyssal species appear to exhibit a very remarkable degree of variation between supposed specific limits, though it would seem as if the conditions under which they live must be remarkably uniform. This would indicate that the tendency to variation is less dependent upon changes in the existing environment than has generally been assumed, if not entirely independent of it; and, conversely, that under uniform conditions (where there can be hardly any struggle for existence) the innumerable variations which occur may coëxist with hardly any elimination, and the equilibrium of characters made temporarily stable by natural selection (which constitutes "species") may fail to be exhibited to a sufficient degree to permit us to take account of it.

In the *American Journal of Science* for November (xx, pp. 390–403), Professor Verrill treats of the remarkable marine fauna occupying the outer banks off the southern coast of New England. This article is a preliminary to the more extended paper in the Proc. U. S. Nat. Museum, hereafter alluded to, and contains brief descriptions of two new genera and three new species of Cephalopods, one new Pteropod, seventeen species and one new genus of Gasteropods, and two of acephalous Mollusca. Several of these appear to be of particular interest, and some seem remarkably close to those described from the *Challenger* collection by Boog-Watson. The *Calliostoma bairdii* V. and S., is the *Calliostoma psyche* of the recorder, named but not described in his preliminary report on the *Blake* dredgings off the gulf and Florida coasts in deep water. This lovely species was dredged

by the lamented Pourtalès many years ago on the Florida reefs. The species referred to in this article are, in part if not wholly, members of the deep sea fauna, strictly speaking. A number of the species mentioned in the article, are described as of "Verrill and Smith," in recognition of the labors of Mr. Sanderson Smith of the Fish Commission, upon the part of the collection embracing the Mollusca.

In the same journal (l. c., p. 284, April, 1880), Verrill gives a "Synopsis of the Cephalopoda of the north-east coast of America," with five plates. This is composed chiefly of notes or additions to knowledge in regard to species heretofore described.

In the Proc. U. S. National Museum (Vol. III, pp. 356–409), Professor Verrill publishes a "Notice of recent additions to the marine Invertebrata of the north-eastern coast of America, with descriptions of new genera and species, and critical remarks on others." This consists of two parts, the first (II) relating to the mollusks, with notes on annelids, etc., collected by the U. S. Fish Commission, and the second (III) comprising a catalogue of Mollusca recently added to the fauna of Southern New England. Although the latter part (pp. 401–409) did not appear until Jan. 10, 1881, the publication, which has also appeared separately, will here be considered as a whole, for the sake of convenience. Part of the new species had previously been published in the *Am. Journal of Science and Arts* for November, as already mentioned.

In this article one hundred and fifteen species of Mollusca are described as recent additions to the fauna of New England, which, almost without exception, have been obtained by the parties employed by the U. S. Fish Commission, directed by Professor S. F. Baird, and under the immediate supervision of Professor Verrill, who has been aided in the work by Mr. Sanderson Smith, Dr. A. S. Packard, Jr., Messrs. Richard Rathbun, H. E. Webster and several other well-known naturalists. Particularly rich results have been obtained in depths from sixty-five to five hundred fathoms, south from Narragansett bay extending to the margin of the so-called "coast shelf" of the continent in this vicinity, about ninety miles from the coast. It may be questioned whether all the forms obtained can be with entire accuracy denoted as belonging to the "New England" fauna, since some of them are, without doubt, members of the true deep sea fauna, and may be found hereafter to extend widely throughout the Atlantic sea-bed

without truly forming part of any of the local faunæ bordering upon it. Among the surprises was the discovery, in some numbers, of nearly fresh shells of *Argonauta argo*, though Lockwood (AMERICAN NATURALIST, XI, p. 243, 1877) recorded the capture of a living individual, probably of this species, on the coast of New Jersey. The species first named in this paper are *Bela sarsii* V. (for *B. cancellata* Sars non Couthouy); *B. hebes* V. from 500 fms.; *Pleurotoma (Pleurotomella) pandionis* V., 238 fms.; *Taranis pulchella* V., 487 fms.; *Neptunea (Sipho) cælata* V., and *N. arata* V., to 500 fms.; *Nassa nigrolabra* V., 155 fms.; *Lunatia levicula* V., 26 fms.; *Rissoa (Cingula) harpa* V., to 365 fms.; *Solarium boreale* Verrill and Smith, 115 fms.; *Acirsa gracilis* V., 100 to 365 fms.; *Aclis striata* V.; *Turbonilla smithii* V., 100 to 120 fms.; *Odostomia (Menestho) sulcata* V., 365 fms.; *Dendronotus elegans* V.; *Polycerella emertonii* V. n. g. et sp.; *Coryphella nobilis* V.; *Cratena veronicæ* V.; *Halopsyche* V. n. g., for *Psyche* Rang., preoccupied; *Lyonsiella gemma* V., 487 fms.; *Neæra multicostata* Verrill and Smith; *Avicula hirundo* L. (?) var. *nitida* V., and several undetermined species. It is of course impossible, within the limits of this report, to summarize fully a publication which is in itself chiefly a summary and a catalogue, nor is it possible fairly to criticise species or identifications from brief diagnoses without figures. It is to be hoped that the authorities of the Fish Commission and Professor Verrill will not allow much time to pass without giving to students good figures of all these new forms, which have been, during the existence of the Commission, from time to time necessarily so briefly and imperfectly described. This is the more necessary now that the investigations of the Commission are encroaching upon the abyssal fauna. Naturalists in several countries are working on similar material, and it is growing to be more and more widely recognized that a description, unless accompanied or soon followed by a good figure, or careful comparison with some well-known and well-figured form, is useless to any one who does not possess specimens for comparison. That the labors of Professor Verrill and his associates should bear their proper fruit and be placed permanently on a sound foundation, must be the wish of every American naturalist, and to bring this about, good figures of their hard earned treasures are indispensable.

One criticism may be permitted. The *Bela simplex* of G. O.

Sars being neither the *B. lævigata* Dall (from Bering strait), nor the *Pleurotoma simplex* of Middendorf, the identification of the species recorded under Sars' name may be considered as still in doubt.

In the November number of the *Valley Naturalist*, Mr. Calkins enumerates twelve species of mollusks additional to his list of marine shells of Florida of 1878.

Some notes on the molluscan fauna of Dominica, are given by A. D. Brown, in the AMERICAN NATURALIST (Vol. XV, No. 1, pp. 56–7), and relate chiefly to the land shells. Mr. Guppy's publications (*Ann. Mag. Nat. Hist.*, 1868) are criticised, and it is stated among the notes that *Amphibulima patula* possesses the power of completely contracting itself within its shell.

A list of "Land and fresh water mollusks of Muscatine county, Iowa," was printed, in 1879, in the History of Muscatine county, (8vo, 1879, pp. 332–3) by Professor F. M. Witter, who also printed a tract of four pages entitled, "Notes on Wyoming Hills," a paper read before the Muscatine Academy of Science, June 2, 1879, which includes notes on various species of recent and subfossil Pulmonata. These publications have not been seen by the recorder.

In the report of the work in 1879 (p. 434) reference was made to a criticism in *Science News*, by Mr. Stearns, of a paper on the shells of Florida by Mr. Calkins. In the same (now defunct) publication (June 15, '79, p. 255), Mr. Calkins replies, maintaining the probable accuracy of the disputed identification of a Floridian *Ranella* collected by him with *R. muriciformis* Brod., a West American species, rather than with *R. caudata* of Say, as Mr. Stearns would suggest.[1]

It seems that there were also published by Mr. Calkins, in 1879, the following papers: "The terrestrial molluscan species of Florida, with notes of personal observation," in the Journal of the Cincinnati Society of Natural History in 1879, and "Note on a rare Californian marine mollusk," in *Science News* of July, 1879.

During the summer of 1880, Mr. T. A. Verkruzen visited the Banks and Newfoundland, and dredged there, beside collecting from several other sources, such as cod stomachs, etc. He pub-

[1] The specimens from Florida having been kindly submitted to the recorder by Mr. Calkins, and compared with authentic specimens of *R. muriciformis*, seem to be specifically different from that Pacific coast species, though belonging to the same general group, and, in general, not dissimilar in characters.

lishes in the January number of *Jahrbuch d. Deutschen Mal. Ges. f.* 1881 an account of his collections. Herein appear descriptions of several forms of *Buccinum*, which no one of our American students has yet thought of separating under a specific name, though very familiar to all. The limitations of species varying with different writers, it is sufficient to say that in this case specific limits seem to be contracted beyond precedent. None of the forms are figured and described but have been already several times named, according to the average view of such things. The figures are fortunately very good.

Introduced Species.—W. H. Ballou (AMERICAN NATURALIST, July, p. 523) states that *Bythinia tentaculata* L., was discovered at Oswego, N. Y., in June, 1879, and has more recently been found in the Champlain canal, at Waterford and Troy, and in the Erie canal, at Syracuse, N. Y.

Verrill (Proc. U. S. Nat. Mus., III, p. 376) notes the occurrence at Newport, R. I., among the docks, of *Truncatella truncatula* Drap., with *Alexia myosotis*, *Assiminea grayana*, etc., in July.

Professor E. S. Morse, in the Bulletin of the Essex Institute (Vol. XII, 1880, Salem, Mass.), has a paper of six pages on "The gradual dispersion of certain mollusks in New England." In it some statistics are given as to the gradual spread of various species, especially *Litorina litorea* L., together with a small map and a figure of the shell.

In the *American Journal of Science* among the zoölogical notes, Professor Verrill alludes briefly (l. c. p. 250, Sept., 1880) to the occurrence of *Truncatella truncatula* and *Assiminea grayana*, at Newport, R. I. (The recorder believes that in 1871, during a brief visit to Wood's Holl, Mass., he obtained a few dead specimens of the former on the beach at that place; at least the specimens agreed with European specimens so named, so far as the shell was concerned.)

Another note (l. c. p. 251) refers to the rapid diffusion of *Litorina litorea* L., on our coast, this species having now reached as far south-west as New Haven, Conn.

In the *Valley Naturalist* (St. Louis) II, 1, Sept., 1880, Mr. L. B. Case speaks of the prevalence of *Zonites cellarius* Müll., in greenhouses, where, however, it is not ascertained to do any damage; unlike an unidentified imported species of *Limax*, which is very destructive to Begonias and other tender-leaved foliage plants.

It may be noted that *Zonites* may be beneficial by destroying the Limaces, as it is believed to be carnivorous.

Descriptive and Miscellaneous Papers.—Very few exclusively of this character have been published during the year, although, as usual, several noted under previous heads, contain descriptive matter.

Octopus obesus and *O. lentus* are described by Professor Verrill as new to the north-east American coast (*Am. Journ. Sci.*, Feb., 1880, XIX, pp. 137–8) from specimens obtained by fishing vessels off Sable island and Le Have bank, and presented by their commanders to the U. S. Fish Commission.

Partula mooreana, from the Island of Moorea in the Pacific, is described as new by Dr. W. D. Hartman (Proc. Acad. Nat. Sci., Phil., 1880, p. 229).

In the *Valley Naturalist* (St. Louis) II, 1, Sept., 1880. p. 6, Mr. Calkins describes *Amnicola ferruginea* n. s., from the Calumet river, Ill., with a woodcut, and gives some "Notes on some Florida Uniones," in which he unites *Unio buckleyi* and *U. buddianus* Lea, specifically, beside considering the distribution of a nearly allied form, *U. blandingianus* Lea. In the December number (p. 53), he describes, with a good figure, *Zonites upsoni*, a new minute and interesting species from Illinois. Mr. Calkins also printed in July, 1880, an octavo catalogue of the Uniones in his cabinet, which comprises some four hundred numbers.

At the meeting of the Am. Assoc. for the Adv. of Science, at Boston, papers were read by Professor E. S. Morse entitled, "Observations of Japanese Brachiopods," and "Notes on Japanese Pulmonifera," but the reporter has not come across, as yet, any published synopsis of these papers, which it is to be hoped will appear in the annual volume.

Professor Alpheus Hyatt, in one of the Teachers' Science Guides (Ginn & Heath, Boston, 1880), has given an account of some of our commoner, economically important mollusks, such as the oyster and clam.

A book, by Mr. Emerton, on the animals of the sea-shore, which (like that of Professor Hyatt just referred to) has not been seen by the recorder, may contain some matter pertinent to this record.

Articles on the economical mollusks appear from time to time in the daily or weekly press. Some of these contain matter

worthy of preservation in more permanent form. Among those of this general nature, which have come under our observation during 1880, the following may be noted: *N. Y. Weekly Herald* of May 1st, On the Oyster business; *San Francisco Weekly Bulletin* Sept. 15th, On Oysters of the Pacific coast and the trade in them; the same Dec. 1st (in eastern correspondence), On the Oyster trade of Baltimore. In the *San Francisco Morning Call*, Dec. 1–12, 1880, appeared a series of letters on Mexican oysters and the possibility of utilizing them, attempts at which, from the vexatious customs regulations of Mexico, and the stupidity of the local officials who enforce them, have hitherto resulted in failure, though the oysters are easily obtained and of good quality.

The collections of shells belonging to various gentlemen in the vicinity of San Francisco, and especially that of Mr. R. E. C. Stearns, perhaps the most scientifically valuable of any *private* collection in the United States, form the subject of an article in the *Sunday Chronicle*, San Francisco, Dec. 26, 1880.

Two papers of real value on "Staten island and oysters," appeared in the *Scientific American* for July 31st and Aug. 7th. In the supplement to that publication for July 10th, J. W. Putnam, C. E., contributes an important essay on the preservation of timber, especially with reference to attacks by boring mollusks such as the Teredo.

The recorder may, perhaps, be permitted here to announce that having discovered that the name *Ceropsis*, used by him for a genus of Carditidæ of the Californian coast, in 1871, is preoccupied, he desires to substitute for it the name *Milneria*, in honor of the late Dr. J. W. Milner of the U. S. Fish Commission. The name *Candelabrum* (used by him in 1878 for a Pleurotomoid genus having the posterior surface of the whorls concave, and with the keel produced backward in spines like those ornamenting the varices of *Murex)*, appears to have been used by Blainville for a radiate, but it does not appear whether Blainville's name has or has not been adopted into science. If a new name be considered desirable, *Ancistrosyrinx* may be used. It comes from deep water off Florida.

NOTES ON THE CODEX TROANO, AND MAYA CHRONOLOGY.

BY DANIEL G. BRINTON, M.D.

THE investigations of Professor Thomas, published in the AMERICAN NATURALIST for August, go far towards dispelling the obscurity which has hitherto rested on this interesting document. In examining its pages some other suggestions have occurred to me which may throw further light on its object and contents.

One question in reference to it is, as to what precise period of time it refers. Up to the present there has been no opinion expressed upon this point, but I think it can be approximately if not definitely determined.

To do so we must decide what was the length of an Ahau. It is true that all the old authors, Landa, Cogolludo, Beltran, Lizana and the Maya chronicler, speak of it as a period of twenty years; and the most recent writer on the subject, Dr. Valentini,[1] insists on this being the proper length. On the other hand, we have the profound Maya scholar, Señor Juan Pio Perez, who very positively maintained that it embraced twenty-four years, only twenty of which, however, were counted, the remaining four being considered "intercalary, and, as it were, non-existent." Although no reason whatever for this odd arrangement has been proffered, I am convinced that Perez is correct, and in addition to the valuable corroborative testimony adduced by Professor Thomas, I shall bring forward a calculation which some time ago dispelled any doubts I had on the subject.

As the Kin Katuns, or periods of 52 years, recurred so frequently that after a few generations they could not be distinguished one from the other, and would thus have led to great confusion in chronology, the Ahau Katun was devised, embracing the much longer period of 312 years, and to it was referred any important event in history. Instead of its purpose being "further to complicate the calendar and to deceive the people," as Professor Thomas thinks, it is, when properly used, an extremely simple and easy means of keeping the run of the years, and converting the one computation into the other. For this purpose the series of numbers was used which has been such a mystery to antiquaries: 13, 11, 9, 7, 5, 3, 1, 12, 10, 8, 6, 4, 2.

[1] "The Katuns of Maya History," 1880.

Gallatin explained them as the numerical characters of the days "Ahau" following the first day of each year called Cauac;[1] Dr. Valentini thinks they refer to the numbers of the various idols worshiped in the different Ahaus; Professor Thomas that they are the number of the year (in the indiction of 52 years) on which the Ahau begins. Each of these statements is true in itself, but each fails to show any practical use of the series; and of the last mentioned it is to be observed that the objection applies to it that at the commencement of an Ahau Katun the numbers would run 1, 12, 10, 8, etc., whereas we know positively that the numbers of the Ahaus began with 13 and continued 11, 9, 7, 5, etc.

The explanation which I offer, is, that the number of the Ahau was taken from the last day Cauac preceding the Kan with which the first year of each Ahau began—for, as 24 is divisible by 4, the first year of each Ahau necessarily began with the day Kan. This number was the "ruling number" of the Ahau, and not for any mystical or ceremonial purpose, but for the practical one of at once and easily converting any year designated in the Ahau into its equivalent in the current Kin Katun, or 52 year cycle. All that is necessary to do this is to *add the number of the year in the Ahau to the number of the year Cauac corresponding to this "ruling number." When the sum exceeds 52, subtract that number.*

Take an example: To what year in the Kin Katun does 10 Ahau XI (the 10th year of the 11th Ahau) correspond?

On referring to a table, or, as the Mayas did, to a "Katun wheel," we find the 11th Cauac to be the 24th year of the cycle; add ten to this and we have 34 as the number of the year in the cycle to which 10 Ahau XI corresponds. The great simplicity and convenience of this will be evident without further discussion.

I now pass to the important question: Can we establish a correct correspondence between the Kin Katuns and the Ahau Katuns with the years of the Christian era?

The attempt has been made with widely divergent results. Perez makes the 13th Ahau begin in 1488, and Gallatin follows him; Valentini has it begin in 1522, but he makes the serious error of supposing the 13th was the *last* Ahau, whereas it was

[1] Trans. Am. Ethnol. Soc., Vol. I, p. 109.

the *first* in the Ahau Katun; besides attributing only twenty years to the Ahau. That both these suppositions are erroneous, will appear by an analysis of a date which has been given us by a Maya writer preserved by Perez and referred to by Professor Thomas. This date is that of the death of Ahpula. A false translation of this important quotation, led Gallatin to suspect an error in the original; but it is entirely correct and intelligible as it stands. The text runs thus:

"In the 13th Ahau Chief Ahpula died. Six years were wanting to complete the 13th Ahau. This year was counted towards the east of the wheel, and began on the 4th Kan. Ahpula died on the 18th day of the month Zip, on the 9th Imix; and that it may be known in numbers it was the year 1536."

Side by side to this must be put a very precise date given by Bishop Landa, and corroborated by native writers. It is to the effect that "the Spaniards arrived at the city of Merida in the year of the nativity of our Lord 1541, which, said the Indians, was precisely in the first year of the period of Eleven Ahau."

Here, then, are two dates which should be reconciled. It looks difficult, at first sight. Counting six years back from 1541, brings us to 1535, not 1536, and Valentini therefore supposes that the Maya chronicler had in view the official incorporation of Merida (Jan. 6, 1542)—though what that would have had to do with the fixed principles of Maya chronology, he does not make clear.

In reality, there is no contradiction at all. The Maya yea. did not begin January 1 as does ours, *but July 16*, at or about the time of the transit of the sun by the zenith in the latitude of Merida. Hence the Maya chronicler identified the 6th year from the end of the Ahau with 1536, because the greater part and the latter part of that Ahau year was actually in A. D. 1536. In point of fact, Chief Ahpula, whoever he was, died Sept. 11, 1535, O. S.

Having fixed this date beyond peradventure, I shall take another step. The Ahau Katun of 312 years, divided into 13 periods of 24 years each, embraces 6 Kin Katuns of 52 years each; yet owing to the properties of the different numbers, the first year of any Ahau will not coincide with the first year of any Kin Katun except at the beginning of the Ahau Katun; and from the date of this coincidence the Ahaus were reckoned *beginning with the 13th* (as Perez positively and correctly states).

Referring again to Chief Ahpula's death, the chronicler states

that it occurred not only in the 6th year from the close of the Ahau, but he also gives it in the Kin Katun reckoning as the year 4 Kan. Now it is obvious that if Ahau XIII is the first of the greater cycle, the number of the year referred to should be the same as the number of the year 4 Kan in the lesser cycle—a coincidence which could not occur except in the first Ahau of the Katun. In fact, 4 Kan is the 18th year of the Kin Katun; and of course $24 - 6 = 18$, the year of the Ahau.

This leads to the result that the coincidence above referred to, which marked the beginning of the greater cycle, occurred July 16, 1517, on which day, for the first time for 312 years, the current Ahau und Kin Katun both began on the day 1 Kan.

With this date thus definitely fixed, it would be easy to construct a table showing the correspondences of the Maya and Christian systems of reckoning. I shall pass, however, to its application to the Codex Troano.

Leaving aside the opinion of the Abbé Brasseur that this manuscript is a sort of geological treatise, and that of Mr. Bollaert that it is a history, all unprejudiced students have agreed that a portion of it at least is a calendar—what the Mayas called *tzolan Katun*, the arrangement of the Katuns or divisions of time, and probably also a *tzolanté*, ritual. The left hand columns of the four plates numbered XXIII, XXII, XXI, XX, as has been noted by Professor Thomas, enumerate a series of 52 years beginning with 10 Cauac, which is the 36th year of the Kin Katun. Could we find anywhere on these plates the number of the Ahau, there would be no difficulty in fixing the exact date of the manuscript. I have no doubt that Professor Thomas is right in believing that the Ahau is indicated in the upper compartment of Plate XXIII; and I had repeatedly sought to make it out there before seeing his article; but unless it is the figure two in red at the top of the column of numbers to the right of the figures in blue, I cannot discern it. Assuming that the date is Ahau II, and the year 10 Cauac, it is obvious from the method of calculating above given that the year with which this calendar begins is that which corresponds to July 16, 1500–1501, and that it ends on the year 9 Ix, Ahau XI—July 16, 1552–1553.

Passing by various other considerations of interest in connection with the Codex, I shall offer one suggestion which, so far as I know, has not heretofore been made.

It is known to all students of the subject that there is no account of the plan adopted by the Mayas to arrange their intercalary days. That they did allow for these days is asserted by all authorities; if they had not done so, they would, as Gallatin observes, have been out of their reckoning twenty days every eighty years; whereas we know that they were only forty-eight hours astray in the time of the transit of the sun by the zenith at the time of the Conquest (Pio Perez).

Their method of intercalating is, I believe, illustrated by the Codex Troano. One of the most instructive pages of that manuscript, is the title page. Were it fully deciphered, we should doubtless have a key to the whole work. It is composed of eleven lines across the page, each presenting either seven numbers or seven figures. The first row from the top of the page is partly erased, but may readily be restored.[1] It represents the hieratic signs of the seven days:

Ymix, Ix, Akbal, Kan, Chicchan, Cimi, Manik.

Below them stand the numbers:

1, 2, 3, 4, 5, 6, 7.

Now of these days, the first three named—Ymix, Ix, Akbal—are the *last* of the series of 20 which make up the Maya month, while the remaining four are in their order, the *first* of the month.

This serves to identify the kind of book the Codex is, for Landa has, among his other obscurities about the Maya calendar, this particularly obscure passage:

"It is curious to note how the dominical letter [of the year] always comes up at the beginning of its year, without mistake or failing, and that none of the other twenty letters appears. They also used this method of counting in order to derive from certain letters a method of counting their epochs and other things, which, though interesting to them, does not concern us much here. It is enough to say that the character or letter with which they begin their computation of the days or their calendar is called *One Ymix* which is this | Sign of day. | which has no certain nor fixed day in which it falls. Because each one changes its

[1] The reasoning of Professor De Rosny on this point is conclusive. See his "Essai sur le Déchiffrement de l'Ecriture Hiératique de l'Amerique Centrale." Folio, Paris, 1876, p. 26.

position according to his own count; yet for all that, the dominical letter of the year which follows does not fail to come up correctly."[1]

This certainly is not to be understood, as has been supposed by M. de Charencey, who has made some excellent studies on this Codex, to mean that the year began with the day Ymix.[2] The contrary is distinctly affirmed by Landa. The true explanation I take to be the following:

Each period of 13 years began with the day 1 Kan, and, counting 365 days to the year, ended on the day 13 Cauac. In each period there should be three intercalary days, every fourth year being properly a leap year. These three days are allowed for by beginning the next subsequent 13 year period, not on the day following 13 Cauac in regular order, but by starting the almanac of the period with Ymix, thus allowing three days to elapse, which would bring 1 Kan of the new year in its proper astronomical position within about half an hour.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— It is refreshing to the ordinary plodding scientific mind, trammeled by the clogs and chains of the inductive method, to read the addresses of some (by no means the majority) of the metaphysicians of the Concord Summer School of Philosophy. Aiming his *a priori* gun at the human soul, Dr. Jones brings it down at the first shot, stuffs it with the Platonic philosophy, and finds, after all, that "the soul exists only as *objectivation*, manifesting itself out of itself." We on the whole prefer this to the degrading conception of the materialists and nescientists who are said to teach that the soul is a function of the brain, as it is really a definition we can understand. We quoted Carlyle's opinion of evolution in a recent number; here is Dr. Jones' deliberate characterization of the evolution theory, doubtless the result of years of scientific research and philosophic induction: "Of the idea of evolution and of the origin of the species, we must think some worthier thought than that of a monkey or gorilla rubbing off his tail and otherwise improving his condition, until, through natural

[1] "Relacion de las Cosas de Yucatan," p. 236.

[2] "Recherches sur le Codex Troano," p. 10, 1876.

selection of condition, he finds himself a spiritual being with an immortal soul." This statement of the evolution theory, which, for intelligence, matches the above quoted definition of the soul, was, so far as we are told to the contrary, received with applause (clapping and stamping is frowned down at the school as materialistic) of the silent sort, as befits a band of Hegelians and Super-platonists. It is currently reported, though the newspapers don't even whisper the idea, that after adjournment each evening the soul of each member of the school "retires into the occiput," where it lies in a trance for the night, contemplating the "*Thingness of the Here.*" Compare these dark orphic sayings and these aspirations of the souls of the Concord Philosophers with the materialistic methods of research of the anatomist or biologist or physicist, and who wouldn't be a Hegelian and Super-platonist!

Dr. Jones, full of anti-"materialistic" ardor, says in another place, "There are no natural forces; matter is inert; the potencies of nature are in spirit, not in matter." Another speaker remarked that "materialists are studying the lower forms of men, and avoid the higher civilization." The venerable Mr. Alcott, returning to the evolution theory, held that "instead of coming up from animals, animals have descended from men, and were possible only because man made himself a beast first." The more liberal and critical mind of Professor Harris, the able and learned editor of the *Journal of Speculative Philosophy*, led him to mildly rebuke these excesses of the transcendental philosophy, and he appeared to look with favor upon the doctrine of evolution, saying, "The descent of the soul does not explain the ascent. If God chooses to make man through matter, or even the ape, that involves no difficulty, for the ape is not man, and has no language nor ideas. Man is none the less made by God by being made through low material forms."

In all seriousness, we would not wish to appear to be making light of genuine philosophic methods, nor of the larger proportion of the noble, inspiring addresses and sentiments of the members of the Concord School of Philosophy. Every scientist is brought face to face with inscrutable problems. Few of them are thoroughgoing materialists as such. The great lesson of science is to teach us to suspend our judgment and to wait for more light, even if the solution of many problems has to be deferred for generations. Least of all can ultimate questions be solved by *a priori*, transcendental obscurities. Meanwhile the scientist warmly repels the charge of materialism, while spending his strength in endeavoring to discover the origin and source of man's physical and intellectual as well as moral nature, and for the present refrains from groundless generalizations on ultimate problems, which he may justly claim that the human mind is no better fitted for solving now than in the days of Plato and Aristotle. Is not

this as truly the evidence of a well-trained, philosophic mind as the utterances of certain illiberal, one-sided philosophers who make a specialty of the writings of some schoolman rather than of the nature of their own mind, and who evince their ignorance and want of appreciation of science and scientific theories or working hypotheses, by dismissing them as "materialistic" and "atheistical." Scientific men are too apt to be dogmatic and censorious in dealing with transcendental and mystical philosophy, but we do not look for this spirit in the philosopher, whose range of vision takes in matter as well as mind and spirit.

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RECENT LITERATURE.

REPORT OF THE STATE COMMISSIONERS OF FISHERIES OF PENNSYLVANIA.[1]—This is the most extended report yet made by the commissioners, covering 151 pages of text, and containing forty-nine engravings, of which forty-four represent species of fishes. Fifty-eight pages are devoted to the results of pisciculture, by the commissioners, and the remainder to a systematic account of the fishes of the State by Professor Cope. The distribution of fishes from the two hatching houses, the eastern and western, has been considerable, and has extended to all parts of the State. There have been sent from the Western house at Corry, Erie Co., *Salmo fontinalis*, *S. salar sebago*, and *S. quinnat*. From the Eastern house at Marietta, Lancaster Co., the same species have been sent, together with *Clupea sapidissima* (shad), *Micropterus salmoides* (black bass) and *Cyprinus carpio* (carp). The most extensive distributions have been of trout and black bass. An important feature of the report is a series of answers to questions propounded by the commissioners as to the condition of the streams in various parts of the State. These inquiries relate to the obstruction, pollution, etc., of the waters, and the answers throw much light on the subject. They should be continued in future years, for the destruction of the fish population of many fine streams will be accomplished, if this matter is not carefully supervised by the commissioners, and the needful legislation carried into effect.

The ichthyological portion of the report includes descriptions of one hundred and fifty-seven species, of which four have been introduced. The descriptions are arranged under the various systematic heads of genera, families, and orders, for which characters are given in accordance with the views of the author. Professor Cope has been a student of this subject for many years, and he has made a good many important discoveries in a field already pretty well occupied. Such may be considered the finding of the genera *Placopharynx*, *Ericymba*, and *Labidesthes*. So also the peculiar arrangement of the intestines in *Campostoma*, where they

[1] Harrisburg; Lane S. Hart, State Printer, 1881.

are wound in a long helix round the swim-bladder. The determination of the structure of the jaws and their functions in the peculiar genus *Exoglossum* was first made in Professor Cope's paper on the Cyprinidæ of Pennsylvania, published in 1861. Professor Cope thinks that additional species will be found in the Ohio tributaries, which now includes half the fresh water fish fauna of the State. The eastern limit of distribution of a number of species is pointed out, and the southern limit of others.

The report contains a great many typographical errors. This is too common in the documents published at our State capitals, and suggests a greater interest in the emoluments of their office than the quality of the work done by the State printers. We know of a case in an adjoining State, where the official whose report was thus mangled, reprinted part of it at his own expense, rather than present the work to the public eye. We were of the opinion at the time that the expense should have been borne by the State printer.

We hope the commissioners will persevere in their work until all our fresh waters furnish a permanent supply of good fish food for our rapidly increasing population.

STUDIES FROM THE BIOLOGICAL LABORATORY OF JOHNS HOPKINS UNIVERSITY.[1]—While this part contains valuable physiological papers by the editor, Prof. Martin, and by Drs. Councilman, Hartwell, and Sewall, we propose to notice here the purely zoölogical memoirs, which are of a high order of merit. In Dr. S. F. Clarke's paper on the early development of the Wolffian body in the common salamander *(Amblystoma punctatum)*, which is illustrated by three well drawn plates, the author states that this body arises from the outer layer of the mesoderm as a solid rod of cells, and is at first largest anteriorly; a split then occurs in the larger portion which begins at the posterior end of the smaller part and travels anteriorly, and at this time a lumen has appeared in the anterior end of the blastema; finally, the split reaches the anterior end thus dividing that portion into two ducts; the lumen is extending itself backward, a small rod of cells has been formed below the anterior end of the ventral duct, the dorsal and ventral ducts are united at one point, and a second opening into the body-cavity from the dorsal duct has been made. This method of development seems to be quite different from that in any allied forms in which the development has been worked out, and, adds Dr. Clarke, it is most like that of the Elasmobranchs.

A paper by Dr. C. Sihler, on the formation of dentine and of osseous tissue is followed by one by Prof. W. K. Brooks and E. B. Wilson on the first zoëa of Porcellana, illustrated with two

[1] *Johns Hopkins University, Baltimore.* Studies from the Biological Laboratory. Editor, H. NEWELL MARTIN; Associate Editor, W. K. BROOKS. Vol. II, No. 1. Published by N. Murray, Johns Hopkins University. June, 1881. 8vo, pp. 134. Subscription price for the vol., $5.00.

plates. It is devoted to a description of the first stages of the larva, the specimens having been hatched from the eggs at Beaufort, N. C. It appears that the larva immediately after hatching is still quite rudimentary in form compared with the more active zoëa after it has cast its first larval skin, which occurs in from two to twenty-four hours after hatching. A second paper by Dr. Brooks is entitled "Alternation of periods of rest with periods of activity in the segmenting eggs of Vertebrates."

HAMLIN'S PHYSICAL GEOGRAPHY AND GEOLOGY OF MT. KTAADN.[1] —This little known and somewhat inaccessible mountain, is one of the grandest peaks in Northeastern America. Its isolation, the great height to which it rises above the surrounding country, the wild, savage desolation of its summit, the sharpness of its peak, the enormous chasm or rent in its side like the crater of a volcano, are features wanting in the White and Green mountains. Moreover it is of peculiar interest from the fact that during the glacial period its peak, like that of Mount Washington, probably stood above the ice sheets, while at an elevation of 4615 feet on its sides, occur boulders of Oriskany sandstone containing fossils, as well as of fossiliferous slates which, in some manner unexplained, have been carried from the lowlands not many miles to the northwestward, apparently not much over 600 feet above the sea. Professor Hamlin's account is full and detailed, and we are glad to know only preliminary to more thorough investigations. The excellent heliotype of a model made of the mountain, will be useful to future explorers and visitors to this wildest, most volcanic-looking of our New England peaks.

Professor Hamlin, from numerous soundings in the lakes of the Ktaadn region, shows that the lakes are shallow, with flat bottoms, enclosed by glacial detritus, as are all the lakes in Maine. Of lake basins excavated in solid rocks, he knows not an instance in Maine. It would seem from this that the lake basins of Maine, though our author does not say so, would, if drained, appear like the ancient lake bottoms which form the sites of many a New England village, and which were formed during the terrace epoch or epoch of great rivers, when the latter were chains of lakes.

The author shows that the Ktaadn region is not a continuous granite area as formerly supposed, but that like the other elevations in Central Maine, it is a mass of intrusive granite rising out of gneiss. He takes the ground, against Sterry Hunt and others, that the "gneiss" is really an eruptive granite, rather than of sedimentary origin, the transitions in many places within a

[1] *Observations upon the Physical Geography and Geology of Mount Ktaadn and the adjacent district.* By C. E. HAMLIN. Bulletin of the Museum of Comp. Zoology at Harvard College. Geological series, Vol. I, No. V. Cambridge, Mass., June, 1881. 8vo, pp. 189–223, with a map and heliotype taken from a model of Mt. Ktaadn.

small area from crystalline rock to distinct schists being, in his view, incompatible with the idea that the former is a metamorphosed portion of the latter. Ktaadn is itself composed of true granite, specimens having been referred to Dr. Wadsworth for microscopic examination. The mountain has been determined, by Professor Fernald, to be 5215 feet high; the parallel of 46° crosses the northern base of the mountain. The drift, boulders and gravel occur as far up as 4600 feet on the sides of the mountain; the drift has been covered with the débris from the mountain summits, or in the author's words, "Ktaadn has thus been buried under its own ruins, and beneath these ruins has been hidden the drift that was deposited when the mountain was comparatively intact."

DARWIN'S POWER OF MOVEMENT IN PLANTS.[1]—There are few botanists indeed who do not prize very highly Mr. Darwin's botanical works—"Climbing Plants," "Fertilization of Orchids," "Insectivorous Plants," "Fertilization in the Vegetable Kingdom," and the "Forms of Flowers." We have now another to add to the list, and it is not too much to say that it fully equals in interest and importance, any of its predecessors. Like them it is the record of a long series of the most patient and painstaking observations and direct experiments, and like them the results are told in the simple and straightforward manner which is the peculiar charm of Mr. Darwin's writings.

Beginning with a short introduction, the authors take up the circumnutating movements in seedling plants, devoting particular attention to the movements of the radicle, or young root, and the cotyledons, or earliest leaves of the plantlet. Curious and ingenious devices were resorted to, for showing the periodic movements of circumnutating parts, and numerous diagrams are given, showing the paths traversed during stated periods. Not only were the parts of the young plantlet found to have periodic movements, but, in many cases at least, they were found to be sensitive to contact or other external influences. The movements of the parts of mature plants are next taken up, and many curious facts are brought out here for the first time. The movements connected with the sleep and waking of plants occupy considerably more than one hundred pages of the book. Heliotropism and its modifications occupy seventy pages or more, and geotropism upwards of fifty more. At the close is a chapter containing a summary which includes some startling suggestions, and food enough for many years of diligent and hard thinking.

The public on this side of the Atlantic, have again to thank the Messrs. Appleton & Co., of New York, for the promptness with which they have brought out the American edition, and at a price which places it within easy reach of all.—*C. E. B.*

[1] *The Power of Movement in Plants.* By CHARLES DARWIN, LL.D., F.R.S., assisted by FRANCIS DARWIN. New York, D. Appleton & Co., 1881.

RECENT BOOKS AND PAMPHLETS.—Dr. H. G. Bronn's Klassen und Ordnungen des Thier-Reichs, Wissenschaftliche dargestellt in Wort und Bild. Fortgesetzt von Dr. A. Gerstaecker, Professor an der Universtät, Fünfter Band, II Abtheilung. Gliederfüssler; Arthropoda 1, 2, 3, Lieferung. Roy. 8vo, pp. 96, VIII plates. Leipzig und Heidelberg, 1881.

Dr. H. G. Bronn's Klassen und Ordnungen des Thier-Reichs, Wissenschaftliche dargestellt in Wort und Bild. Fortgesetzt von C. K. Hoffmann, Doctor der Medicin und Philosophie, Professor in Leiden. Sechster Band. III Abtheilung. Reptilien 18, 19, 20 und 21, Lieferung. Royal 8vo, pp. 27, IX plates. Leipzig und Heidelberg.

Neue Reptilien von Gautemala und Westaustralien beschrieben. Von Dr. J. G. Fischer, in Hamburg. 8vo, pp. 16, 2 plates. Bonn, 1881. From the author.

Fauna der Gaskohle und der Kalksteine, der Permformation Böhmens. Von Dr. Ant. Fritsch. Band I, Heft 3. Roy. 4to, pp. 32, 12 plates, cuts. Prag, 1881. From the author.

Sur un procédé Coloration des Infusorises et des Eléments Anatomiques, pendant la vie. Par M. A. Certes. 4to, pp. 8. Paris, 1881. From the author.

Rapports des Commissions Internationales. Congrès Geologique International 2me Session, Bologne, 1881. Imprimerie Fova et Gasagnani. Bologne, 1881. 8vo, pp. 140. From the commission.

Bibliothèque Universelle. Archives des Sciences Physiques et Naturalles, Troisième Periode. Tome V. Congrès Geologique International Session de Bologne, 1881. Report du Comite Suisse sur L'unification de la Nomenclature. Geneve, 1881. 8vo, pp. 14. From the author.

Note Complementarie sur la Preparation et la Conservation des Organismes. Par A. Gertes. Seance du 12 Avril, 1881. Extrait du Bulletin de la Société Zoologique de France. Pour L'Année, 1881. Paris. 8vo, pp. 4. From the society.

Le Moniteur de la Flotte. Lloyd Francais Organe des Intérets Politiques, Maritimes et Commerciaux, de la France et des Colonies. Paris, 1881. From the publisher.

Le Musée Geologique de Lausanne en 1880. Rapport Addresse a la Commission des Musées par le conservateur, E. Renevier, professeur. 8vo, pp. 29. Bull. Soc. Vaud. Sc. Nat. XVII, I Sep. Lausanne, Juin 1, 1881. From the author.

Reseña Fisica y Geológica de la Provincia de Giudad-Real. Por D. De Cortazar, Ingeniero Jefe del Cuerpo de Minas. Roy. 8vo, pp. 40, 1 map. Imprenta y fundicon de Monuel tello. Madrid, 1881. From the director.

Gaceta Cientifica de Venezuela, Revista Qumcenal de las cincias Medicas. 4to, pp. 10. Caracas, 1881. From the publisher.

Memoria Botanica Sobre el Embarbascar O Sea. La Pesca por Medio de Plantas Venenosas. Por A. Ernst. (Del Tomo I de los esbrozos de Venezuela. Por A. A. Level.) 8vo, pp. 16. Imprenta Bolivar, 1881, Caracas. From the author.

Las Familias mas Importantes del Reino Vegetal especialmente las que son de interes en la Agricultura e industria, O que estan representadas en la Flora de Venezuela, Resumen del curso de Botanica sistimatica, leido en la Ilustre Universidad central. Por A. Ernst. 8vo, pp. 82. Imprenta de espinal e Hijos, Caracas, 1881. From the author.

Fenomenos Periodicos de la Vegetacion estudio correspondiente al ano de 1879. Por Mariano Bárcena, Director del Observatorio Meterologico Central. Imprenta de Francisco Diaz de Leon. Mexico, 1881. From the director.

Anales del Ministerio de Fomento de la Republic Mexicana. Tomo IV, royal 8vo, pp. 508. Imprenta de Francisco Diaz de Leon. Mexico, 1881. From the Observatorio Meterologico Central Mexicano.

Leucifer; a study in Morphology. By W. K. Brooks, associate in biology and director of the Chesapeake Zoological Laboratory of the Johns Hopkins University, Baltimore, Md., U. S. A. Communicated by Professor Huxley, Sec. R. S. Received April 6, 1881. From the Proceedings of the Royal Society, No. 212, 1881. 8vo, pp.2. London, 1881. From the author.

The Scientific Roll and Magazine of Systematized Notes. Conducted by Alexander Ramsay, F. G. S. Climate. Vol. I, May, 1881. London. From the editor.

A Catalogue of works on Natural History. By Bernard Quaritch. London, 1881. From the author.

Milford's Literary Microcosm. August. 4to, pp. 8, illustrated. New York, 1881. From the editor.

The later Tertiary of the Gulf of Mexico. By E. W. Hilgard, Berkeley, California. 8vo, pp. 12, 1 map. From the American Journal of Science, Vol. XXII, July, 1881. New Haven, 1881. From the author.

Census Bulletin No. 222. Ownership of the National Debt—Registered Bonds. By Robert P. Porter, special agent on Wealth, Debt and Taxation. 4to. pp. 10. Deparment of Interior, Government Printing Office, Washington, 1881. From Hon. Francis A. Walker, Superintendent of Census.

Notes on Salmonidæ of the Upper Columbia. By Capt. Chas. Bendire, U.S.A. pp. 40.

Observations on Siredon lichenoides. By Wm. E. Carlin. pp. 24.

Descriptions of New Fishes from Alaska and Siberia. By Tarleton H. Bean. pp. 66. From the Proceedings of United States National Museum (8vo, pp. 81). Government Printing Office, Washington, 1881. Through the Smithsonian Institution.

Extra Census Bulletin. Statistics of Life Insurance. 4to, pp. 74. Deparment of the Interior, Government Printing Office, Washington, 1881.

The Official Gazette of the United States Patent Office, containing the Patents, Trade-marks, Designs and Labels. Vol. XIX, No. 26. Vol. XX, Nos. 2–4. Published by authority of Congress. Government Printing Office, Washington, 1881.

Report of the cruise of the U. S. Revenue Steamer "Corwin" in the Arctic ocean, By Captain C. L. Hooper, U.S.R.M. 8vo, pp. 76, cuts. Government Printing Office, Washington, 1881. From S. W. Clark, Chief Revenue Marine.

A memoir upon Loxolophodon and Uintatherium. Henry F. Osborn, Sc.D. Accompanied by a Stratigraphical Report of the Bridger beds in the Washakie basin, by John Bach McMaster, C.E. Vol. I, No. 1. Contributions from the E. M. Museum of Geology and Archæology of the College of New Jersey. 4to, pp. 54, VI plates, map. Princeton, 1881. From the authors.

Book of the Black Bass. By. Dr. J. A. Henshall. 8vo, pp. 468, plates and cuts. Bound. Robert Clarke & Co. Cincinnati, 1881. From the publishers.

New species of Fossils, and remarks upon others, from the Niagara group of Illinois. By S. A. Miller, Esq. 8vo, pp. 11, 1 plate. From the Journal of the Cinnati Society of Natural History. Cincinnati, 1881. From the author.

The Palæontologist, June 10, 1881.

Contributions to Palæontology; Fossils of the Lower Silurian Formation; Ohio, Indiana and Kentucky. By U. P. James. Roy. 8vo. pp. 12. Cincinnati, 1881. From the author.

The Journal of the Cincinnati Society of Natural History, July, Vol. IV, No. 2. 8vo, pp. 90, 2 plates. Cincinnati, 1881. From the society.

Proceedings of the California Academy of Sciences, at its regular meeting held June 6, 1881. Reception of Lt. Robert M. Berry, U.S.N., commanding the U. S. Steamer "Rodgers" of the Jeannette Search Expedition. 8vo, pp. 20. San Francisco, 1881. From the society.

The State and Higher Education; an address before the Minnesota Academy of Natural Sciences. By Professor N. H. Winchell. 8vo, pp. 18. Ext. from the Academy. Minneapolis, 1881. From the author.

Index to papers on Anthropology. Published by the Smithsonian Institution, 1847 to 1878. 8vo, pp. 8. Reprint from the Smithsonian Report for 1879. Government Printing Office, Washington, 1881.

North American Mesozoic and Cænozoic Geology and Palæontology; or an abridged history of our knowledge of the Triassic, Jurassic, Cretaceous and Tertiary formations of the Continent. By S. A. Miller. 8vo, pp. 338. From the Journal of

the Cincinnati Society of Natural History, Oct., 1879. Cincinnati, 1881. From the author.

The Foundation of American Dermatology; being the President's address at fourth annual meeting of the American Dermatological Association held at Newport, R. I., August 31, 1881. By Louis A. Duhring, M.D. 8vo, pp.30. Ext. from the Transactions of the Association. Philadelphia, 1881. From the author.

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GENERAL NOTES.

BOTANY.[1]

Botany in Minnesota.—The University of Minnesota opened, during July, a Summer School of Science, in which instruction by lectures and laboratory practice was furnished in chemistry (Professor Dodge), geology (Professor Hall), and botany (Professor Bessey). About forty teachers enrolled themselves for the courses. The botanical laboratory, supplied with twenty-five microscopes, was open from 9 A.M. to 5 P.M., excepting the lecture hour, from 11 to 12 o'clock. The Mississippi river, above and below the falls of St. Anthony, and the long cañon, with its high cliffs, extending from the falls to Fort Snelling, together with the innumerable lakes in the vicinity of Minneapolis, supplied an abundance of material for study. The cooler climate of Minnesota made work possible even in the heated term of this ever-to-be-remembered July. The laboratory course may be given in outline as follows: I. *General Histology of Plants.*—Protoplasm in hairs and tissues, cells, cell walls and their markings, chlorophyll, starch, plant crystals, parenchyma, collenchyma, sclerenchyma, fibrous tissue, laticiferous tissue, sieve tissue, tracheary tissue, epidermis, stomata, hairs, fibro-vascular bundles. II. *The Structure and Physiology of Cryptogams.*—(1) The Sexless Plants (Protophyta) Protococcus, Nostoc, Oscillatoria, Rivularia, yeast plant, Bacteria; (2) The Unisexual Plants (Zygosporeæ), Hydrodictyon, Conferva, Desmids, Diatoms, Spirogyra, Mucor; (3) The Egg-spore Plants (Oösporeæ), Œdogonium, Vaucheria, Peronosporæ, Cystopus, Fucus; (4) The Red Seaweeds and their allies (Carposporeæ), Podosphæra, Eurotium, Parmelia, Puccinia, Agaricus; (5) The Mosses and their allies (Bryophyta), Marchantia, Mnium; (6) The Ferns and their allies (Pteridophyta), fern prothallia, and fruiting, Pteris, Polypodium, Selaginella. III. *The Structure and Physiology of Phanerogams.*—The structure of Gymnosperms; the sexual reproduction of Monocotyledons; the sexual reproduction of Dicotyledons.

The Study of Algæ in the United States.—About nine years ago Dr. H. C. Wood, of Philadelphia, published his now well known "Contribution to the history of the fresh water Algæ of North America," which made it possible for the student to begin the systematic study of our fresh water species. Within

[1] Edited by Prof. C. E. Bessey, Ames, Iowa.

two or three years, Dr. Allen and Dr. Halsted have pretty well worked up our Characeæ (which we must regard as Algæ, in the face of the fact that algologists regard them as falling within the jurisdiction of the bryologists). It is a pleasure now to notice the important contribution made by Dr. Farlow, whose "Marine Algæ of New England and the adjacent coast," appeared early in July. It is reprinted from the belated "Report of the U. S. Fish Commission for 1879," and consists of 200 pages of text, accompanied by fifteen plates. The author has been connected with the Fish Commission for many years, and has thus had most excellent opportunities for studying the Algæ of our North Atlantic coast. How well he has improved those advantages even a casual examination of this valuable book will show. It is designed to be used as a hand-book for the classification of the species (excepting the Diatoms) of our coast from New Jersey northward, and it is not too much to say that the author has been entirely successful in making a book which every sea-coast visitor with botanical inclinations will find indispensable.

In his introduction Dr. Farlow discusses some peculiarities in the distribution of our Algæ which are interesting, as follows: "It will be seen that Cape Cod is the dividing line between a marked northern and a southern flora. In fact, the difference between the floræ of Massachusetts bay and Buzzard's bay, which are only a few miles apart, is greater than the difference between those of Massachusetts bay and the Bay of Fundy, or between Nantucket and Norfolk. This difference in the flora corresponds precisely with what is known of the fauna. That Cape Cod formed a dividing line was known to Harvey, and subsequent observation has only shown, on the one hand, that the flora north of Cape Cod is more decidedly Arctic than he supposed, and that, on the other hand, south of the cape it is more decidedly that of warm seas. The general fact of the distinctness of the two floræ is not weakened by the knowledge that we now possess, owing to the investigations of the Fish Commission, of the existence in a few sheltered localities north of Cape Cod, of some of the characteristic species of Long Island sound, and in a few exposed spots south of the cape, of northern species." Further on, in speaking of the characteristic species between Boston and Eastport, he says: "In studying these we must turn not to the works on the Algæ of France or Great Britain, but rather to those on Scandinavian Algæ. It is especially instructive to examine the Algæ Scandinavicæ, by Professor Areschoug, in connection with our own forms. The resemblance is at once striking." South of Cape Cod the Florideæ are characteristic, and here West Indian and even Adriatic forms appear.

The general classification is as given below, beginning as is happily becoming the custom, with the simpler forms and passing to the higher. Order 1. *Cryptophyceæ*, nearly equivalent to Cy-

anophyceæ or Phycochromaceæ, and containing the sub-orders Chroococcaceæ and Nostochineæ. Order II. *Zoosporeæ*, with the sub-orders Chlorosporeæ, Bryopsideæ, Botrydieæ, Phæosporeæ. Order III. *Oosporeæ*, with sub-orders Vaucherieæ and Fucaceæ. Order IV. *Florideæ*, including sub-orders Porphyreæ, Squamarieæ, Nemalieæ, Spermothamnieæ, Ceramieæ, Spyridieæ, Cryptonemieæ, Dumontieæ, Gigartineæ, Rhodymenieæ, Spongiocarpeæ, Gelidieæ, Hypneæ, Solericæ, Sphærococcoideæ, Rhodomeleæ, Corallineæ.

THE LITERATURE OF BOTANY.—Mr. B. D. Jackson's "Guide to the Literature of Botany" (Longmans, Green & Co., and Dulau & Co., London), will prove indispensable to the working botanist. It is not simply a list of all the botanical publications, but a selected and classified list, so that when one consults it he is not obliged to hunt through a great mass of less important matter. The selections have been quite well made, and as the book contains 6000 titles not found in Pritzel's "Thesaurus" (not 6000 *more*, as we thought from the prospectus and so noted in the June "Notes") it should at once find a place upon the shelves of every botanist's library. The general appearance of the book, which contains over six hundred small quarto pages, is good, and the typographical errors are, considering the nature of the work, remarkably rare.

A HINT TO MICROSCOPISTS.—The editor of this department, since the publication of his "Botany for High Schools and Colleges," has been in receipt of numerous inquiries from teachers and others, who, for want of time or the necessary training, are unable to prepare illustrative specimens for study or demonstration. It is, of course, true that it is far better to study fresh material, and the teacher who can direct his pupils how to collect and prepare their own specimens is doing the best work. But the fact remains that for a very great number it is impossible for them, with their thousand and one other duties, to take upon themselves the additional labor required to supply, at the proper time, the proper illustrative specimens. To meet the wants of such cases, and they are numerous, why cannot some of our microscopists put up sets of mounted slides, designed to show the more important structures, in a well selected list of illustrative plants. A set of twenty-four specimens, somewhat as follows, would be useful. *Protophyta*—(1) Protococcus, (2) yeast plant; *Zygosporeæ*—(3) Hydrodictyon, (4) Diatoms, (5) Spirogyra, (6) Mucor; *Oosporeæ*—(7) Volvox, (8) Vaucheria, (9) Peronospora, (10) Fucus; *Carposporeæ*—(11) a fruiting Red Alga, as Nemalion, (12) Erysiphe, (13) a lichen, as Usnea, (14) *Puccinia graminis* in all its stages, (15) sections of mushroom, (16) Chara or Nitella; *Bryophyta*—(17) antheridia and archegonia of a moss, (18) spores and capsule (in section) of a moss; *Pteridophyta*—(19) prothallium of a fern, (20) spores and sporangia of a fern, (21) macro-

spores and microspores of Selaginella; *Phanerogamia*—(22) pollen, (23) young pistil (sections) and ovules, (24) seeds (sections) with embryo *in situ*. The specimens should, in some cases, be of considerable size, and in every case, where possible, the sexual reproductive organs should be clearly shown. The list might profitably be much enlarged, while a valuable half set costing much less might be made by selecting from the full set, say by taking Nos. 1, 2, 5, 8, 12, 16, 17, 19, 20, 22, 23, 24.

ERRATA.—Through some delinquency in the U. S. mails, the editor of this department failed to receive the proof of the August number in time to correct some typographical errors. On p. 653, third line, Myxomycetes appears spelled incorrectly; the second word in the fourth line should be "fine"; Professor Tuckerman's name appears without an r, for which we beg his pardon; further down Dr. Farlow is said to have described "a carpinus which grew in a jar of water"! which no doubt made many botanists stare with amazement. What we wrote was "coprinus," a very different thing indeed! The additions to the N. A. Flora made by Dr. Engelmann, were "some additions," not "Iowa additions."

A correction should also be made in Dr. Schimper's paper, p. 558, fifth line, where "less watery" should be "more watery."

BOTANICAL NOTES.—In the April number of the *Journal of the Linnean Society*, Francis Darwin publishes an interesting paper on "The theory of the growth of Cuttings." The other articles of this number are on the Vegetation of Chumba State and British Lahoul; Australian Fungi; New plants from the Cape of Good Hope; An Erythræa new to England; Revision of the genus Vibrissea. The June number of the same journal contains an article on the power possessed by leaves of placing themselves at right angles to the light, by Francis Darwin. It is illustrated by seventeen woodcuts, five of which are explanatory of the klinostat, or apparatus which he used in making his observations. This portion of the article is of especial value to those who wish to repeat or extend Mr. Darwin's observations. Papers on the coffee leaf disease, proliferous *Verbascum nigrum*, stipules in *Ilex Aquifolium*, and Right and Left hand contortions, complete the number. In the last mentioned article the writer, Mr. Clarke, uses some pretty vigorous English in discussing the vexed question of the direction of the spiral; for example: "I suppose myself to have shown, (1) That Linnæus's original definition of right hand twist is exceedingly good, and contains no surplusage; (2) That in observing contortions it makes no difference whether you imagine yourself within or without the spire, so long as you do not turn yourself round, or stand upon your head." All will agree with him "that it does not much matter which way it is settled, but that it is of the greatest importance to all botanic describers that it should be settled, definitely and finally, one way

or the other.——C. B. Clarke's paper in the July *Journal of Botany*, "Notes on Commelinaceæ," is very interesting as containing a summary of the order as it is to appear in the forthcoming volume of De Candolle's "Monographies." In the same journal, J. G. Baker catalogues the ferns collected by Kalbreyer in New Granada, and describes twenty-one new species.——J. B. Ellis, in the July *Torrey Bulletin*, describes eleven new species of Fungi from Utah, collected by M. E. Jones.——A notice of the Muhlenberg Herbarium, now in possession of the American Philosophical Society in Philadelphia, and a continuation of the List of the State and local floras of the United States, occur in the same number of the *Bulletin*.——Dr. Rothrock's paper on "Home and foreign methods of teaching Botany," in the July *Botanical Gazette*, is one which should be read by every teacher of botany in the country. It contains a strong plea for *the study of plants rather than books*. In the same number Dr. Engelmann describes several new species of plants, among them a suffrutescent Portulaca. C. H. Peck also describes some new Fungi from Utah. ——C. F. Wheeler and E. F. Smith, of Hubbardston, Mich., have just issued a "Catalogue of the Phænogamous and vascular Cryptogamous plants of Michigan." It contains entries of 1634 species, of which 1559 are flowering plants. Valuable notes are appended to many of the species, and a good map of the State is added. The authors offer a limited number of copies of this valuable catalogue for sale at fifty cents each.——Dr. E. L. Sturtevant, well known for his many important contributions to economic botany, has just added another, "The growing of Indian Corn," a pamphlet of fifty pages, extracted from the Twenty-eight report of the Massachusetts State Board of Agriculture.

ZOÖLOGY.

A Shower of Cyclops quadricornis.—I have just received (June 12) from C. L. Garretson, of Salem, Henry county, Iowa, a small vial containing about half a teaspoonful of water, accompanied by a note in which he says, "On the night of June 8, 1881, there was a heavy rain-fall, and on the morning of the 9th the ground was covered, in places, with something that looked like blood. I found that they were living creatures, and with a spoon took up a pint of the muddy water containing them."

Upon examining the sample received, I found it to be swarming with *Cyclops quadricornis*, or what I take to be that species. The only thing peculiar about them, is, that the body is full of bright red corpuscles, which accounts for their imparting a red appearance to the water containing them. A specimen of the same creature taken from a jar of water that has been standing in my office for several weeks, contains a few of these corpuscles, but not a hundredth part as many as are in the bodies of the rain-

water specimens. While it might not be considered remarkable that a few of these animals should be found in pools of rain-water, I am puzzled to understand how they came here in such immense numbers, unless we suppose that they were distributed through the whole body of rain that fell, and were afterwards concentrated by the draining away of the surplus water. There were not less than five hundred in the sample of water sent me, of which about one-third were alive when received, after having been tightly corked for several days.—*F. E. L. Beal.*

Mussel and Insect Climbers.—In *Psyche*, Vol. III, No. 80, just issued, Victor Tousey Chambers states an interesting fact regarding the minute larva of the Tineid, *Aspidisca saliciella* Cham. He says the method by which it climbs a tree or weed, "is one of the most surprising in the insect world." The larva is footless, nor does it gain a foothold by the exudation of any glutinous, or other secretion; yet encumbered by its case, it climbs trees, fences, &c. "The larvæ travel solely by their silk. Successive taps are given with the end of the spinneret to the surface on which the larva lies, thus a minute byssus is formed, to which the spinneret adheres, the body is then contracted, so that the under surface of the case is attached. The head and segments are again extended, and another byssus is made, and the body contracting, the case is again brought up and attached. Its attachment is only by a few silken threads, each of which is less than 0.0002^{mm} in diameter, and the fresh silk readily stretches or breaks. This is the sole mode of progress of the larva."

I have thought it would add to the interest of the above, to ask the reader to compare it with our account of the mode of perpendicular climbing as practiced by the black mussel, *Mytilus edulis*, in American Naturalist, Vol. IV, 1871, p. 331. As there described, the climbing of this mollusk is almost identical with that of the larval Tineids described by Chambers. The operations of the mussel being on a larger scale were easily observed, hence each step in the process is given. The figure of the mussel, is, by an unfortunate misunderstanding of the printer placed wrong. The umbo, or pointed end of the shell, should be down, and the nib, or open end, should be up. Then against the three sets of byssus let the imagination put the perpendicular side of a rock, and we have the animal in climbing position. My object in not drawing the rock was simply to save expense in engraving.—*Samuel Lockwood, Freehold, N. J., May, 1881.*

A Woodchuck Climbs a Tree.—About two years ago a young man who was living with me, came in one day saying that he had just seen a small animal, possibly a raccoon, ascending a tree in the woods some sixty rods away. Taking my shot-gun, I went to the place, where I soon saw the creature in the top of a black oak tree, almost forty feet from the ground. The animal seemed

very cunning, and managed for some time to keep on the opposite sides of some of the larger limbs, but I finally got a shot at him. He came to the ground with a bounce, when I found it was a woodchuck. It was but slightly wounded in one of the fore legs, and I captured it and took it home. I put it in a hollow tree near my residence, and it remained there a couple of weeks, freely eating the corn which I regularly fed it. But one night it emigrated, and I saw it no more. These animals are not plentiful in this region, indeed in a residence here of twenty-four years, I have only seen one other specimen, though occasionally hearing them mentioned. Until this incident, I did not know that they ever ascended such tall trees.—*Charles Aldrich, Webster City, Iowa, June 9, 1881.*

CARPHOPHIOPS HELENÆ IN INDIANA.—This species of serpent was originally described from specimens obtained at Monticello, Miss., and in Southern Illinois. I have a specimen that was captured by Mr. Charles Jameson, of Indianapolis, in Brown county, Indiana. The locality is about forty miles south of Indianapolis. —*O. P. Hay.*

EUTÆNIA RADIX IN INDIANA.—In the Museum of Butler University there is a good and well characterized specimen of *Eutænia radix*, that I have every reason to believe was found at Irvington, near Indianapolis. The species is found at Bloomington, Illinois, and is included, by Dr. W. H. Smith, in his "Catalogue of the Reptiles and Amphibians of Michigan," as occurring in that State.—*O. P. Hay, Butler University, June 15.*

HABITS OF THE YELLOW-BELLIED WOODPECKER.—I found, at Buckfield, Maine, early in July, a yellow-bellied woodpecker's nest, and with it collected a large section of a white birch tree that shows their marks in vertical instead of horizontal rows, and is a proof that they eat the sap if not also the bark. The humming-birds were very thick around the tree, sucking the sap where it was running from the holes; there were also butterflies and moths around it. The nest was very peculiar, being placed on the north side of a tall poplar.—*H. C. Bumpus.*

PROBABLE CAUSE OF THE LONGEVITY OF TURTLES.—So far as we are aware, no attempt has been made to explain the unusual longevity of turtles, whose lives, as is well known, span over a century. There appears to be no longer-lived animals than these beings of slow gait and slow manner of life. The following facts may throw light on the cause of their great age. In the first place they are protected by their solid shell from the attacks of snakes, fishes and birds; young turtles, we are informed by Professor J. W. P. Jenks, are sometimes carried off by herons, but in adult life they are probably rarely eaten by other animals. Has any one ever found any empty turtle shells? As some turtles lay but two or three eggs a year, nature seems to have

counted upon an immunity from the ordinary evils of childhood in these animals. It is probable that the larger proportion of, indeed most, young turtles when hatched survive, and when two or three years old, are fitted to resist successfully ordinary fish and avian enemies. They are not exposed to vicissitudes of weather; the fact that the period of egg-laying (in New England from June 10–20) is so constant, and varies so little at different seasons, shows that they are hardy and tough. Finally, the persistence of the type of gigantic tortoises on the Galapagos islands, indicate the wonderful vitality of this type of life in resisting prolonged climatic and geological changes.—*A. S. Packard, Jr.*

The Trichina and other Animal Parasites.—Renewed attention has been drawn to the Trichina. According to the *Penn Monthly*, Dr. Leidy has recently stated that this parasite was first discovered by an English surgeon in 1833, but its presence in pork was first detected by Dr. Leidy himself in 1840. He reminds the public for their comfort: 1st, that all food animals are liable to have parasites, and that the tape-worm is sometimes conveyed in rare beef; 2d, that only one hog in about ten thousand is infected with trichinæ; and, 3d, that thorough cooking will kill all such parasites, while none of them are poisonous after a good cooking. He believes that the Mosaic prohibition of pork was due to the danger of trichinosis, in a country where fuel was scanty, and, therefore, their food seldom well cooked. He thinks that millions may have died of trichinosis in the centuries before the true source of the danger was discovered, and that many of the deaths which occurred in the army during the Civil War were due to the frequent use of raw and badly cooked pork, although ascribed to typhoid, rheumatic or malarial fevers.

For a general account of the trichina and allied parasites we would refer the reader to an excellent book[1] published a few years ago by Professor Van Beneden, a Belgian naturalist, who, by the way, was the first to discover the history of the transformations of the tape-worm. Van Beneden divides animal parasites into several categories. The first are free messmates, which only live as boarders or *commensals* in the bodies or in intimate relations with other animals, such as hermit crabs, the pilot fish, Remora, etc.; second, the fixed messmates, as barnacles, etc.; third, mutualists, such as a certain louse of the dog, which harbors a larval tænia; and lastly parasites, which include leeches, lice, fleas, ticks, ichneumon flies, and finally the genuine parasites, such as the tape-worm and trichina, which migrate from one host to another in order to complete their metamorphoses. It is the cheapest, most reliable and best illustrated work of the kind we have seen.

[1] Animal Parasites and Messmates. By Professor P. J. Van Beneden. With 83 illustrations. The International Scientific Series. New York: D. Appleton & Co. 1876. 12mo, pp. 274.

THE TAIL IN THE HUMAN EMBRYO.—This is a subject of considerable interest in view of the occasional statements regarding tailed races of men in the interior of Africa, and of the supposition that the human embryo has a tail homologous with that of the monkeys, and that, therefore, in this respect, man passes through a monkey-stage, as insisted upon by Haeckel, who remarks in his "History of Creation," Vol. I, p. 308, "Now, man in the first months of development possesses a real tail as well as his nearest kindred, the tailless apes (orang-outang, chimpanzee, gorilla), and vertebrate animals in general. But, whereas, in most of them—for example the dog, it always grows longer, in man and in tailless mammals, at a certain period of development, it degenerates and finally completely disappears. However, even in fully developed men, the remnant of the tail is seen in the three, four or five tail vertebræ (vertebræ coccygae) as an aborted or rudimentary organ, which forms the hinder or lower end of the vertebral column." Now this notion is rudely disputed by Professor His, who contradicts in a paper on this question (abstracted in the Journal of the Royal Microscopical Society) the assertion that at a certain stage in its development the human embryo has a true tail, which is afterwards absorbed. As to the definition of a tail, Professor His considers that the caudiform or tail-like prolongation is a true tail when, extending beyond the cloaca, it contains a number, greater or less, of supernumerary vertebræ. Without this condition there is merely a caudiform appendage. His knows of no well-authenticated case of supernumerary vertebræ in the human embryo, and pathological observation he believes to coincide with embryological knowledge in justifying the assertion that in man the normal number of thirty-four vertebræ is never exceeded.

Prof. His' paper appeared in 1880; the same year, however, Dr. Leo Gerlach published in Gegenbaur's Morphologisches Jahrbuch (Band VI, Heft. I.) a paper on a case of tail-formation in a human embryo. He refers to a case of the occurrence of a tail in an abnormal embryo described in 1840 by Dr. Fleischman. On holding the fœtus up to the light there appeared, in the first third of the eight-lines-long tail, five dark points through the thin skin, which he regarded as vertebræ, the continuation of a spine. The end of this tail seemed to be skinny, and was very delicate and transparent. This embryo forms the subject of Gerlach's exhaustive anatomical account before us. The embryo is 10.8 centimeters (four inches) long and was in the early part of the fourth month of embryonic life. The free portion of the tail is 12^{mm} in length; it is long and slender, being in length equal to that of the foot of the embryo. In this tail a well-marked notochord is present. The organ, therefore, should be regarded as the homologue of a genuine tail, and Gerlach considers it as a case of atavism, and that it represents an earlier phylogenetic condition. He thinks, for rea-

sons which he assigns, that at an earlier embryonic date there were a longer notochord, a longer medullary tube and a greater number of primitive or proto-vertebræ. In an embryo a few weeks older, on the other hand, the notochord would entirely disappear. Haeckel's view, therefore, is, so far as one abnormal example is concerned, apparently sustained against that of His.

New Type of Parasitic Crustacean.—A new parasitic Cirriped (*Laura*) has been discovered by Lacaze-Duthiers, according to the Journal of the Royal Microscopical Society, living as an Antipatharian coral (*Gerardia*). Externally it is kidney-shaped, and its body, composed of twelve segments with six pairs of limbs, is imbedded in the soft parts of the coral; it is a little over a centimeter long, with a carapace formed of two scales or valves united along the median line, and is from two to four times as long as the body. The carapace is hard externally with a soft internal layer; between these there is lodged the liver and one of the genital glands, together with a very rich vascular plexus. The external covering is riddled by a large number of small ducts, the outer orifices of which are covered by a membrane, which is surrounded by delicate filaments; these are of a cartilaginous consistency, and have a central duct. A study of the circulatory organs shows that the tissues on the inner face of the carapace are supplied with a rich capillary plexus, which surrounds all the organs, and gives rise to nutrient lacunæ. These communicate with the internal orifices of the canals, so that we may say that Laura gives off thousands of radicles, which force their way into the tissues of the coral. The peculiar arrangement of the digestive system confirms this view. As regards this, the liver is of great size, the digestive tube is a closed sac, with no mouth or vent, and is always full of a yellow, pultaceous matter, which appears to be similar to the hepatic secretion.

The food is absorbed by the walls of the carapace, the absorbed products are purified by the biliary secretion, which here at any rate appears to have a depuratory function. The ovary and testes occur in the same individual. The young are born in the Nauplius condition.

Cilia and possible Nervous System of Infusoria.—In a recent essay on cilia, Prof. J. W. Engelmann, referring to the Infusoria, says that notwithstanding the very high specialization of these "unicellular" organisms, he could not detect among them intracellular fibers subtending the cilia, such as those which occur in the ciliated epithelium of Lamellibranchs. Of this kind are not the muscular striæ of Stentor, alleged by Simroth to be in connection with the cilia beneath which they course. This connection Engelmann could not confirm. Certain it is that the ciliary movements of Stentor are independent of the general contractions of the body.

Do the Infusoria possess an approximation to the nervous sys-

tem of the higher animals? It was thought by the late Professor H. J. Clark (see his "Mind in Nature") that the higher Infusoria had a nervous system or something analogous to it. Engelmann now says (Journal of the Royal Microscopical Society for April) that the Infusorian, *Stylonychia mytilus*, has unquestionably a system of ventral fibers trending from near the middle line, beneath the ectoplasm, to the two conspicuous series of large admarginal cilia, which aid so powerfully the motions of this huge animalcule. But these fibers are not like the fibers of ordinary ciliated cells, nor are the lashes which they supply cilia, properly so called. The lashes are complex appendages, remote from one another, moving independently under the control of their possessor. Each has its own fiber, which is pale, soft, homogeneous, and not more than 0.2 μ across. The fibers are parallel and so delicate that they can only be seen for a short time in specimens starved during some hours in filtered water, and then killed in osmic acid. Are not these fibers truly nerves? Why, asks Engelmann, should not the higher Infusoria possess a nervous system? May not more exact researches soon decide this question in the affirmative? Has not *Panophrys flava* eyes? If not so what is the function of the watch glass-shaped organ with its pigment-spot?

New Genera of Cuttle Fishes.—In the Transactions of the Danish Academy of Science, Professor Steenstrup describes two interesting genera allied to Sepia, under the name of *Sepiadarium kochii* and *Idioscpius pygmæus*. They inhabit the Indian ocean. One of the arms of the 4th ventral pair in the males is adapted to serve as a fertilizing organ (a hectocotyle), the female receiving the spermatophores on the internal face of the buccal membrane. The distinguished author closes his memoir with a comparative view of all the known genera of Myopsidan cephalopods.

Note regarding change of color in Diaptomus sanguineus.—I visited the Glendale pond July 27th, and found thick swarms of this Copepod. Only a few had egg-sacs, and no male was found; while the females were not red, but bluish. The antennæ had remained red, also the furca, but the postabdomen was yellow, and the body and legs bluish.—*C. F. Gissler.*

New Discoveries concerning Deep-sea Crustacea of the Gulf of Mexico.—Additional information of a good deal of interest has since our last note on this subject been published by A. Milne Edwards. From an abstract in the *Journal* of the Royal Microscopical Society, it appears that forty new generic types were discovered, while certain groups which had been supposed to be absent from the American seas are very richly represented at these great depths. Crabs proper disappear below 500 meters from the surface: at 800 meters, however, there was found Bathyplax, which takes the place of Gonoplax of the French coast, but it is blind. Representatives of Willemoesia were found at 3500 meters, and these too were blind.

The infinite variety of the forms is, however, the most astonishing point, transitional types abound, and groups hitherto regarded as very distinct are now linked by intermediate forms. As examples, the author cites the Paguridæ, generally placed among the Anomura, and which have as yet had no link uniting them to the Macrura; now there is *Pylocheles agassizii*, in which the abdomen is not soft and asymmetrical, but is formed of solid regular rings, and terminated by swimmerets. This creature lives in holes, which it closes by means of its claws. *Mixtopagurus* has the abdomen more developed on the right than on the left side, and divided into seven segments, of which the last two are alone large and hard. There are some curious adaptive modifications: *Eupagurus discoidalis*, which lives in the tubular shells of Dentalium, has one of its claws spherical. Xylopagurus lives in holes in wood, and has its abdomen converted into an operculum for covering one of the two holes of its retreat. Similar connecting links were found between the Dromidæ and the Homolidæ, and on the whole the author concludes that submarine explorations will aid palæontological investigations in gradually filling up the lacunæ now existing in zoölogical systems.

The Musk Sheep.—In Dr. Bessel's account of the North Pole expedition published in German, and noticed in *Nature*, valuable accounts of this animal are given. None of those killed by the members of the expedition had a very marked musk smell. The author is uncertain whether this peculiarity is to be attributed to the very high latitude in which they were obtained, or to their having been killed out of the breeding season. No difficulty was found in distinguishing the tracks of these animals from those of reindeer, although some former observers have not found this easy. In all the herds there are from ten to twenty cows to one bull. Their whine is somewhat like the snorting of the walrus, and never resembles in the least the cry of the goat or the sheep. When danger approaches they never give signal with their voice, but only by stamping or striking their neighbor with their horns. They have dire combats with bears sometimes, and often come off victors.

Zoological Notes.—The organization of an Echiurus-like Sipunculoid worm (*Thalassema mœbii* Greef), has been studied by Greef, who regards the anal pouches of the Echiuri as branchiæ comparable to the aquiferous lungs of Holothurians.—— The organs of taste in the Heteropod mollusks are considered by Professor Todaro to have the same structure as in mammals. They are arranged in two or three rows on each side of the mouth cavity, or externally on the proboscis of Pterotrachea. They are little papillæ with internal sense-cells situated next to the termination of the nervous fibrilla, while externally they each carry a long sensitive hair, and the different sensitive hairs of these cells traverse the canal of the cuticular layer, and arrive at the

level of the gustatory pore.——In the Annals of the New York Academy of Sciences, Mr. R. E. C. Stearns publishes a paper on the existence of a colony of *Helix aspersa* in California, which was planted twenty-three years ago at San José. He also remarks on the geographical distribution of certain West American land-snails, and corrects previous errors concerning them.——In *Nature*, Mr. W. A. Herdman collects the evidence brought forward by Charles Julien, which shows strong ground for the belief that the little understood "neural gland" in the Ascidians, represents the glandular portion of the *hypophysis cerebri*, or pituitary body of vertebrates.——At a recent meeting of the Royal Society of London, Professor W. K. Parker, in a paper on the structure and development of the skull in sturgeons, remarks in closing, that the sturgeons as a group cannot be said to lie directly between any one family of the Selachians and any one family of the bony Ganoids, yet, on the whole, that is their position; the bony Ganoids, on the whole, approach the Teleostei, especially such forms as Lepidosteus and Amia, which have lost their "spiracle," and in other points are less than typical, as Ganoids. Larval sturgeons are, in appearance, miniature sharks; for a few weeks they have a similar mouth, and their lips and throat are beset with true teeth that are molted before calcification has fairly set in. Their first gills are very long and exposed, but not nearly so long, or for such a time uncovered, as in the embryo of sharks and skates.

A CORRECTION.—On pp. 585 and 586 of the July NATURALIST, a serious inadvertency occurs. In the list of strictly fresh-water shells is mentioned *Helicina occulta* (by typographical error printed *oculata)*. Though Helicina is not a pulmonate, the species here indicated is strictly terrestrial in its habit. The reader will therefore refer it to the preceding list of land shells, where the intention was to have placed it.—*R. Ellsworth Call.*

ENTOMOLOGY.[1]

THE CULTIVATION OF PYRETHRUM AND MANUFACTURE OF THE POWDER.[2]—*The use of Pyrethrum as an Insecticide.*—Up to a comparatively recent period the powder was applied to the destruction of those insects only which are troublesome in dwellings, and Mr. C. Willemot seems to have been the first in the year 1857 (?) to point out its value against insects injurious to agriculture and horticulture. He goes, however, too far in his praise of it, and some of his statements as to its efficacy are evidently not based upon actual experiment. Among others he proposes the following remedy: "In order to prevent the ravages of the weevil on wheat fields, the powder

[1] This department is edited by Professor C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

[2] Continued from July number.

is mixed with the grain to be sown, in proportion of about ten ounces to about three bushels, which will save a year's crop." This is simply ridiculous, as every one who is familiar with the properties of Pyrethrum will understand. We have during the past three years largely experimented with it on many species of injurious insects, and fully appreciate its value as a general insecticide, which value has been greatly enhanced by the discovery that it can be most economically used in liquid solution; but we are far from considering it a universal remedy for all insects. No such universal remedy exists, and Pyrethrum has its disadvantages as has any other insecticide now in use. The following are its more serious disadvantages: 1. The action of the powder, in whatever form it may be applied, is not a permanent one in the open air. If, *e. g.*, it is applied to a plant, it immediately affects the insects on that plant with which it comes in contact, but it will prove perfectly harmless to all insects which come on to the plant half an hour (or even less) after the application; 2. The powder acts in the open air—unless, perhaps, applied in very large quantities—only upon actual contact with the insect: if *e. g.*, it is applied to the upper side of a cotton leaf the worms that may be on the underside are not affected by it; 3. It has no effect on insect eggs nor on pupæ that are in any way protected or hardened.

These disadvantages render Pyrethrum in some respects inferior to arsenical poisons, but, on the other hand, it has the one overshadowing advantage that it is perfectly harmless to plants or to higher animals; and if the cultivation of the plant in this country should prove a success, and the price of the powder become low enough, the above mentioned disadvantages can be overcome, to a certain degree, by copious and repeated applications.

In a closed room the effect of Pyrethrum on insects is by far more powerful than outdoors. Different species of insects are differently affected by the powder. Some resist its action most effectually, *e. g.*, very hairy caterpillars and especially spiders of all kinds; while others, especially all Hymenoptera, succumb most readily. In no case are the insects killed instantaneously by Pyrethrum. They are rendered perfectly helpless a few minutes after application, but do not die till some time afterward, the period varying from several hours to two or even three days, according to the species. Many insects that have been treated with Pyrethrum show signs of intense pain, while in others the outward symptoms are much less marked. Differences in temperature and other meteorological changes do not appear to have any influence on the effect of Pyrethrum.

Modes of Application.—Pyrethrum can be applied, 1. In dry powder; 2. As a fume; 3. As an alcoholic extract diluted; 4. By simple solution of the powder in water; 5. As a tea or decoction.

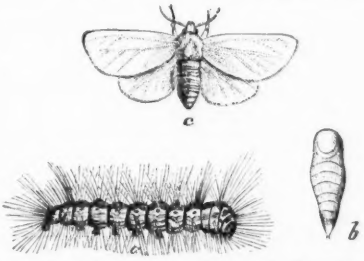
The following recommendations are based on repeated experiments in the field:

1. *Applications of Pyrethrum as dry powder.*—This method is familiar to most housekeepers, the powder being used by means of a small pair of bellows. It is then generally used without diluent, but if it is unadulterated and fresh (which cannot be said, in many instances, of the powder sold at retail by our druggists) it may be considerably diluted with other pulverized material without losing its deadly effect, the use of the powder thus becoming much cheaper. Of the materials which can be used as diluents, common flour seems to be the best, but finely sifted wood-ashes, saw-dust from hard wood, etc.; in short, any light and finely pulverized material which mixes well with the Pyrethrum powder, will answer the purpose. If the mixture is applied immediately after preparation, it is always less efficacious than when left in a perfectly tight vessel for about 24 hours, or longer, before use. This has been proven so far only with the mixture of Pyrethrum with flour, but holds doubtless true also for other diluents. Mr. E. A. Schwarz experimented largely under our direction with the mixture of Pyrethrum and flour for the Cotton Worm, and he found that one part of the powder to 11 parts of flour is sufficient to kill the worms (only a portion of the full-grown worms recovering from the effects of the powder), if the mixture is applied immediately after preparation; but if kept in a tight glass jar for about two days, one part of the powder to 22 parts of flour is sufficient to kill all average-sized worms with which the mixture comes in contact. For very young cotton worms a mixture of one part of Pyrethrum to 30 parts of flour, and applied one day after preparation, proved most effective, hardly any of the worms recovering.

An ordinary powder bellows will answer for insects infesting dwellings or for plants kept in pots in rooms, or single plants in the garden, but it hardly answers on a large scale out-doors, because it works too slowly, the amount of powder discharged cannot be regulated, and there is difficulty in covering all parts of a large plant. Another method of applying the dry powder is to sieve it on to the plants by means of sieves, and this method is no doubt excellent for insects that live on the upper side of the leaves. For large, more shrub-like plants with many branches and for insects that hide on the underside of the leaves this method will be found less serviceable. A very satisfactory way of applying the powder on large plants, in the absence of any suitable machine or contrivance, is to throw it with the hand after the manner of seed-sowing. This method is more economical and rapid than those mentioned above and it has, moreover, the advantage that, if the plants are high enough, the powder can be applied to the underside of the leaves. *(To be continued.)*

THE CATERPILLAR NUISANCE IN CITIES: HOW TO SUPPRESS IT.—In the public interest you have already drawn attention to the numerous caterpillar nests that are now disfiguring the shade trees in most parts of the city. These trees are a marked and beautiful feature of Washington, and our Park Commissioners cannot be too greatly praised for their endeavors to properly care for them and protect them from injury. In this good work they should be aided by all public spirited citizens. I have thought, therefore, that a few suggestions in reference to this caterpillar nuisance would be timely and might do some good.

This Web-worm, known in entomological works as the fall web-worm *(Hyphantria textor)*, is one of the most wide-spread and injurious insects in the country, feeding, as it does, on all sorts of trees, and occurring everywhere east of the Rocky mountains. The parent is a white moth, more or less spotted with black, which issues in spring from the cocoon in which the chrysalis has hibernated, generally near, or just below, the surface of the ground, but also in any other sheltered situation. The pale yellow eggs are laid, to the number of 300 and upward, during the last days of May and the earlier part of June, in this latitude, in one uniform batch, slighly interspersed with white hairs from the body of the female. They are not easily noticed, and it is useless to attempt their destruction in a general way. Immediately upon hatching, the young worms feed together on the parenchyma of the leaf, leaving nothing but the epidermis. As they grow they spread from leaf to leaf, enclosing whole branches with their web, and few attempts are made to destroy them until they have rendered themselves conspicuous, and are nearly full-grown as at the present time. At this stage there is no more available way of destroying them than by pruning off the infested twigs and branches, care being taken to subsequently destroy the worms. A wad of cotton, or other material, attached to the end of a long pole, saturated with kerosene or coal tar and ignited will also do good service in burning them. But on all the smaller trees of the city that can be readily reached with a hand pump, there is a much simpler remedy which might be uniformly employed by the Commissioners at trivial expense. With a little practice the first affected leaf or leaves can be detected during the first days of June before the trees shows any disfigurement. If at such time the parts of the tree where the young caterpillars have been noticed be



Hyphantria textor; *a*, larva; *b*, chrysalis *c*, moth (after Riley).

sprinkled with water in which London Purple has been mixed in proportion of about 1 pound of the purple to about 100 gallons of water, the young worms will all be destroyed thereby and no further disfigurement of the tree ensue from them. A second application about the middle of June to the more limited number of worms that hatch from eggs laid after the first application, may also be desirable. The purple can be got at wholesale from Hemingway & Co., New York, at from 6 to 10 cents a pound, and a few dollars' worth would answer for the trees of the whole city. It would pay the Park Commission to have a special tank built and mounted on wheels for this purpose, with a force pump that might be worked with two men, while a third handles the atomizing nozzle through which the poisoned spray should be applied. One of the simplest and most satisfactory nozzles of this kind is made by two converging holes so that the two jets of water break each other as they issue. Important improvements in the mode of atomizing will be published in the next report of the Entomological Commission; but it is not necessary to illustrate them in this connection. A tank for poisoned water, such as I have indicated, would not only prove valuable in protecting the trees from this particular caterpillar, but from most injurious insects that attack them, as, *e. g.*, the imported Elm-leaf beetle, which is so bad on the elms in the grounds of the Department of Agriculture and elsewhere. No better investment can be made by the authorities.

For private gardens and parkings I would recommend one of the ordinary force-pumps, and the Nelson aquæpult will be found particularly satisfactory.—*C. V. Riley, in Washington Evening Star.*

BLEPHAROCERIDÆ.—Mr. J. Q. Adams, of Watertown, N. Y., writes under date of June 28th, that he recently found what, from our description in a late number of the NATURALIST, he recognized as Belpharocerid pupæ. They were in a very cold stream of water in the country back of Watertown, where the water ran over smooth slate rock with numerous falls. They soon died and became foul, however, when transferred to still water. We subsequently succeeded in obtaining specimens in the pupa and imago state and they proved to be genuine Blepharocerids, the species not yet determined.

REMARKABLE CASE OF RETARDED DEVELOPMENT.—Mr. J. D. Graham, of the Kansas State Agricultural College at Manhattan, has sent us for identification the eggs and newly hatched young of a locust which, on examination, proved to be of *Caloptenus spretus.* The facts connected with these eggs and their hatching are so remarkable, that few persons would be willing to credit them were the circumstances not given with care and by a competent observer. He writes: "These eggs were buried in the fall

of 1876, and a sidewalk was laid immediately above them. This walk has not been moved since that time, until the eggs were found. The earth which covered the eggs was principally clay, old mortar and bits of stone, though there was some black earth immediately surrounding the eggs."

The eggs were found, it seems, while men were cleaning away an accumulation of spalls, mortar and clay, and the sidewalk above referred to, in the rear of the laboratory. We learn that the eggs were about ten inches below the sidewalk and certainly not deep enough to be entirely out of the influence of the changing temperature of the year. Appearing fresh when dug up they were placed by Mr. Graham under favorable conditions for hatching, and in due time a lively swarm of locusts issued.

We have, in our own experience, in rearing insects, often known of retarded development both in larvæ and pupæ to the second and even the third year; but in this instance we have a well authenticated case of eggs remaining unhatched for nearly 4½ years. The fact that the species is *Caloptenus spretus* (which, to our knowledge, so abounded around Manhattan in the fall of 1876 that the ground all around the college was absolutely full of eggs) is confirmatory of the statement of Mr. Graham, because the species did not occur there nor in that part of the country last fall, nor in fact during any year since 1877. The eggs above referred to must be a retarded remnant of those which were so thickly laid there in the fall of 1876 and which gave birth to the destructive multitudes of young locusts the ensuing spring.

Promotion of Silk-culture in California.—Mrs. Theodore H. Kittell, corresponding secretary of the California Silk-culture Association, San Francisco, Cal., writes: "We have, through our efforts, succeeded in convincing our people of the practicability of home silk culture, and by lectures, distribution of pamphlets, mulberry seeds, slips and silkworm eggs we have now so animated the public that complete success seems certain, if we shall be able to start a filature for the reeling of the silk produced. Our society takes the liberty of asking you as one of the most urgent workers for silk-culture in America to give us your advice as to a filature, and the best and cheapest mode of preparing the fiber for the market."

We would refer for our opinions on the subjects mentioned to our "Manual of Instructions for the production of Silk," which can be obtained, upon application, of the Commissioner of Agriculture.

Locust Flights in Dakota.—Mr. Geo. W. Hart of Columbia, Brown Co., Dakota, reports that a flight of locusts *(Caloptenus spretus)* passed over that place from 11.30 A. M. to 3.30 P. M. on the 7th of July, coming from S.S.E., the wind being strong and the weather dry. On July 16th, another correspondent, Mr. F.

C. Kelley, of Jamestown, Dakota Ter., reports a flight as passing over that place without giving the direction of the flight. Large numbers of the common dragon-fly, *Diplax rubicundula* Say, were mingled with the locusts.

THE HESSIAN FLY.—In many parts of Central and Southern Illinois and in Missouri this insect has been reported as doing considerable damage, many farmers having to plow up their winter wheat in consequence. Mr. Thomas H. B. Moulder, of Cane Pump, Camden Co., Mo., sent the insect in the flax-seed state, the latter part of June, with the statement that he had forty acres of wheat which all fell or broke down about two weeks before ripening, from the insect's injuries. The western agricultural papers have had abundant notices of the Hessian Fly this season, but as our eastern entomologists, as a rule, do not see those journals, it is more than probable that this year would be put down by them as one in which the species was not heard of or known. The present year is, however, not exceptional, and more or less injury has been done by this insect in the West every year since we have given any attention to entomology.

THE GENUINE ARMY WORM IN THE WEST.—While the reports of the appearance of the army worm in New York, noticed in the July number of the NATURALIST, proved to be, as there stated, due to the injuries from *Nephelodes violans* and a supposed Pyralid larva,[1] the true army worm has since appeared in force in Central Illinois and adjacent parts of Indiana, doing much injury during the latter part of July, especially to oats. It has also been reported from Wisconsin and Michigan, but investigation indicates that in those two States other insects have been mistaken for the army worm. There is no question, however, about those in Illinois and Indiana, as we have received specimens from different correspondents, and have had the matter investigated by Mr. L. O. Howard, of the Department of Agriculture. From the facts which he gathered, it would seem that the autumn of last year was rather dry in the region devastated and that this spring was an average and favorable one, being neither unusually wet nor dry. It becomes very evident that the eggs were laid the present year, either by the moths that had hibernated or by a second generation of moths, the latter seeming, from all the facts gathered, most probable.

A NEW IMPORTED ENEMY TO CLOVER.—Again we have to report the sudden appearance in this country of an insect which, though well known in Europe for almost a century, was never known to do any serious harm there to crops. We refer to *Phytonomus punctatus* Fabr., a member of the Curculionid family,

[1] We have since bred the moth from this larva and it proves to be *Crambus vulgivagellus* Clem (= *chalybirostris* Zell). Professor Lintner had previously bred a specimen of what he considered *Crambus exsiccatus*. Both are common species of the genus.

which every one who has traveled in Europe, and has paid any attention to insects, will doubtless have met with under stones, sticks, etc., in pastures and meadows. Mr. L. D. Snook of Barrington, Yates Co., N. Y., sent us during the latter part of July a number of specimens of this beetle, with the statement that it greatly injures clover on his farm. Further particulars as to the nature of the damage have not yet been received. It is worthy of remark, that this imported enemy to clover made its first appearance in the same county from which, three years ago, we first reported another European beetle affecting the same plant, viz., the clover root-borer (*Hylesinus trifolii* Müll).

Another Enemy of the Rice Plant.—To the enemies of the rice plant already mentioned and discussed by us elsewhere, viz., *Chalepus trachypygus* and *Lissorhoptus simplex*, we have now to add a third one, and this time of the Order Lepidoptera. It is the larva of *Laphygma frugiperda*, well-known to be destructive to most grasses and grains. Rice suffered greatly from it this summer in Georgia, and we determined the species from specimens sent us by Mr. W. Barnwell, of Savannah.

Canker Worms.—One of the next striking examples of devastation by the spring canker worm (*Paleacrita vernata*) which has ever come to our knowledge, is that to the orchards of Mr. J. W. Robeson, of Taswell Co., Ill., which were this year so seriously affected as to be nearly killed and ruined.

Lepidopterological Notes.[1]—*Ægeria acerni* Clem. (Rep. vi, p. 110).—Mr. D. S. Kellicott has an interesting article in the *Canadian Entomologist* for January, 1881, on the Ægerians inhabiting the vicinity of Buffalo, N. Y., in which he states that the chrysalis of this species in his locality, does not agree with my description as "unarmed," if that description refers to the dorso-abdominal teeth. A re-examination of my specimens shows that my statement applies to the absence of these teeth. It is, however, possible that there is some variation in this regard, and that the eastern specimens from the hard maple differ from the western ones from the soft maple in having the teeth, as indicated by Mr. Kellicott.

Hyphantria textor Harr. (Rep. iii, 130).—There is no doubt in my mind, from frequent breeding of specimens, that this is synonymous with *cunea* Drury, and *punctata* Fitch, which are but varieties, Drury's name having priority.

Callimorpha fulvicosta Clem. (Rep. iii, 132).—Grote and Robinson give the synonymy of this species in their "List of Lepidoptera of N. A.," etc., *lecontei* Boisd., having priority. The late Jacob Boll bred all the forms from larvæ feeding on the same plant.

[1] From advance sheets of Bulletin vi, U. S. Entomological Commission, by C. V. Riley, being a general index and supplement to the nine Reports on the Insects of Missouri.

Samia columbia Smith (Rep. IV, p. 107).—Mr. Herman Strecker has given a beautiful figure of the male of this species in his "Lepidoptera Rhopaloceres and Heteroceres," etc., 1875 (Pl. XII, Fig. 3), and Mr. F. B. Caulfield has described and figured the larva *(Canadian Entomologist*, X, p. 41, 1878), showing that it is structurally identical with that of *cecropia*, and differs only in the intenser green of the body, in the lateral tubercles and bases of the others being white instead of pale blue, and in the upper thoracic tubercles being of a deeper coral red. It accords more with the *cecropia* larva in the fourth stage. It is placed as a good specimen in Grote's "List of N. A. Platypterices," etc. (Am. Phil. Soc., 1874), but I am still of opinion that it should not be considered a distinct species, but simply a well-marked local color variety worthy of name. There is great variation in color, whether of the larva, cocoon or imago, in *cecropia*.

Callosamia angulifera Walker (Rep. IV, p. 122, note).—This is still considered a good species by systematists. Mr. Akhurst finds that it is rather constant from larvæ which seem to differ in no respect from those of *promethea*, but which feed on the tulip tree *(Liriodendron tulipifera)*, and make the cocoon near the ground without pedicel.

Celæna renigera Stephens (Rep. I, p. 86).—Referred by Grote to Hadena. Specimens in the Fitch collection marked with names evidently from Walker, *infecta*, *egens*, *defectua*, *subcadens?* and *murcinaculata* seem to be all synonyms and mere variations.

Prodenia autumnalis Riley (Rep. III, p. 116 and subsequently). —As stated in the eighth report (p. 48) this in the more typical form is recognized as *Laphygma frugiperda* Sm. and Abb. The variety *obscura*, as Professor Zeller, who has seen it, informs me, is so near the European *exigua* Hübn., that it is not easily distinguished.

ANTHROPOLOGY.[1]

THE SACRIFICIAL STONE OF THE CITY OF MEXICO, IS IT GENUINE OR NOT?—In the city of Mexico are offered for sale, casts in plaster of the so-called sacrificial stone now in the courtyard of the museum in the city of Mexico, of which much has been written to prove its genuineness. These casts are much reduced in size, and do not contain the groove of the original. The maker, like many of his countrymen living in the city of Mexico, may not believe in the genuineness of this stone's history; many assert that it was not the sacrificial stone of the Aztecs used in the city of Mexico. No doubt the basin in the center, and groove running from it across the top and down the sides were made after the ornamentation was completed. As this is claimed to represent the journeying of the Aztecs to the city of Mexico, why did they not cut the groove first, then the historical representation?

[1] Edited by Prof. OTIS T. MASON, 1305 Q Street, N. W., Washington, D. C.

As it is, the figures through which the groove is cut, are partially effaced. The groove was evidently cut after the completion of the stone, and in a very rough, uneven manner, passing through the figures in order to give a false importance to a carved stone, which, if allowed to tell its own tale, or, rather, if its history had not been destroyed so as to attach a false representation to it, would still be a valuable monument.

One would think that an object designed for so important a purpose, would have been dressed into shape at the same time, without having to pick up an accidental stone and improvise it for an occasion. If the figures on the surface represent the journeying of the Aztecs to the valley of Mexico, then it did not take many to form the procession. Is there not a great probability that this so-called sacrificial stone had a useful purpose? We are led to this conclusion by seeing scattered about many large round stones, both plain and ornamented, yet without grooves. In the old mills of the early Spaniards, are to be found the very counterparts of these. And why did the Indians want a stone with a hole in it, to retain the heads of prisoners as they were severed? A round object allowing the head to hang over so as to bare the neck for the knife, would be better adapted for the purpose, than to lay the head in a hole with the neck contracted. Is it proved that the Aztecs cut off the heads of their victims? All the stone knives the writer has seen with edges of sufficient length, strength and sharpness, would be poor, slow tools for the cutting off of the numerous heads said to have been daily removed by Montezuma. In the collection of antiquities are several obsidian knives marked "sacrificial knives used by the Aztecs," all of which are better adapted to cut off the tops from turnips and carrots, than human heads, especially if bones were suddenly hit, as the brittleness of these knives would be their speedy destruction. If these so-called Aztecs burnt their dead as a national custom, why accuse them of cutting off human heads to appease their gods? It was only giving the Spanish priests a pretext to call them idolators; so they called it sacrificing human beings. It was good religious capital to work upon. One proof of their burning their dead is, that no graves have been found in the country they occupied, that are older than the Spanish conquest. The Chichimecs, called Aztecs, could not cut off the heads of all their victims; some would die. Why are they not found? There are three skeletons in the museum of the city of Mexico, which were obtained in the old Inquisition building of the city, of those who were starved to death because of their refusal to yield to church dictation. They find no bodies because they were all burnt according to custom. a usage continued to the present day by their kin the Apache, the Yuma, Mojave and others,—plain, simple Indians, not fond of the pageantry attributed to them by the conquerors, who must fictitiously give them

importance in order to throw reflected greatness upon their conquest.—*Edward Palmer.*

ANCIENT PUEBLO WORKSHOP.—On the north bank of the Rio San Juan, in Southern Utah, about twenty or thirty miles below the mouth of the Mancos cañon, in the summer of 1875, I discovered the site of an ancient aboriginal workshop, where axes and hatchets had formerly been made in large numbers. On an elevated ledge overlooking the river, I gathered together in the space of half an hour, upwards of twenty stone axes of various sizes and in different stages of manufacture. They were all made of the natural, rounded, water-worn stones of the river, such as we call cobble-stones, varying in length from four to ten inches. As a general thing, the flat stones, which approached most nearly the desired form, had been selected, and the majority of them had simply a groove roughly chipped out around one end. None of the specimens exhibited any traces of surface-pecking. In some examples the edge had been commenced by flaking off small fragments on each side, whilst a few had been superficially sharpened by abrasion. One highly polished celt, of the long, narrow variety, such as the one figured in Hayden's Report for 1876, Pl. XLVI, Fig. 3, and two or three broken specimens were included in the series. They were all found on the surface, scattered through a large number of stones which had evidently been carried there for the same purpose. The ledge or small plateau on which they were found, did not exceed two hundred feet in length and fifty in width.—*E. A. Barber.*

FRENCH ANTHROPOLOGY.—The *Revue d'Anthropologie*, Vol. IV, No. 2, April, 1881, furnishes the following communications:

Broca, Paul—Anthropologie Zoologique. La torsion de la humérus et le Tropométre. pp. 193–210.

Benzengre, B.—Etude Anthropologique sur les Tatars de Kassimoff, pp. 211–221.

Hamy, Dr. E. T.—Les Négres de la Vallée du Nil: Impressions et Souvenirs, pp. 222–235.

Bordier, Dr. A.—Japonais et Malais. [A chapter in pathologic Anthropology, being a lecture delivered Jan. 15, 1881, before the "Ecole d'Anthropologie" in the Course of Medical Geography.] pp. 236–246.

Chantre, Ernest—Ancienneté des Nécropoles préhistoriques du Caucase. Renferment des Crânes Macrocéphales. pp. 247–254, plates I, II.

Kuhff, Dr.—De la Platycnémie dans les races humaines, pp. 255–259.

Rochebrune, Dr. A. T.—Etude morphologique, physiologique, et ethnographique sur la Femme et l'Enfant dans la Race Ouolove, pp. 260–294, plate III.

Vars, Ed.—Review of the works of N. J. Zograf and H. B. Bozdanov on the Samoyedes, pp. 295–305, with tables.

Mortillet, G. de—Review of the Marquis of Nadaillac's work on the first men and prehistoric times, pp. 306–309.

Zabarowski—Review of Archæology in *Ztschr f. Ethnol.*, Berlin, 1879 and 1880, pp. 309–312; of Hartmann's "Les Peuples de l'Afrique," pp. 330–332; Le Cerveau et ses fonctions, by J. Luys, pp. 336–339.

Martinet, Ludovic—Review of Archæology at the French Association, 1880; *Bulletins de la Soc. d'Anthrop. de Paris*, 1879; and the Archæology of Charents, pp. 312–326; Lesson's "Les Polynésiens, leur origine, leur migrations, leur langage," pp. 339–343.

Deniker—Review of Dr. R. Hartmann's "Der Gorilla Zoologisch—Zootomische Untersuchungen, Lpzg., 1880, pp. 327–330.

Letourneau, Ch.—Review of Le Bon's "L'Homme et les Sociétés leurs origines et leur histoire, Paris, Rothschild, 2 vols., 1879–80," pp. 332–336.

Manouvrier—Review of French and Italian journals, pp. 344–349.

GERMAN ANTHROPOLOGY.—The third part, thirteenth volume, of *Archiv für Anthropologie*, published March, 1881, will be found to contain the following papers:

Kollmann, J. (Basel)—Beiträge zu einer Kraniologie der Europäischen Völker, pp. 179–232, tables II, III, IV.

Scheiber, S. H. (Bukarest)—Untersuchungen über den mittleren Wuchs der Menschen in Ungarn, pp. 233–267.

Hagen, Fritz Bessel—Zur Kritik und Verbesserung der Winkelmessungen am Kopfe; mit besonderer Rücksicht auf ihre Verwendung zu weiteren Schlussfolgerungen und auf ihre mathematisch sichen Bestimmung durch Konstruction und Berechnung, pp. 269–316.

SHORTER COMMUNICATIONS.

Asbóth, O. (Budapest)—Ein Hochzeitsbrauch in Südrussland. Translated from the Russian, pp. 317–321.

Fürst, Carl M. (Stockholm)—Ueber das Vorkommen des Trochants tertius beim Menschen, pp. 321–322.

Fligier, Dr., Reviews of—Miklosich's "Travels in Rumania, Istria and the Carpathians;" Pic's "Origin of the Rumanians;" Diefenbach's "Ethnology of Eastern Europe, especially the Hämos peninsula and the Lower Danube;" Helbig's "Die Italiker in der Poebene;" Alton's "Beiträge zur Ethnologie Ostladiniens;" Kuno's "Prehistoric Rome;" the Celts; and works by Schwartz, Jirecek, Hasden, Valroger, Robion, Luchaire, Sanpere y Miguel, Alton, Biderman, Benloew, Gerard de Rialle, Tomaschek, Arnold and Kopernicki, pp. 323–335.

Fischer, George—Reviews of the archæological publications of Doctor Lovisato Domenico, and Bandelier's Art of War among the Mexicans, pp. 335–346.

Ecker, A.—Reviews of Bischoff's "Brain weight of Men," and Jöger's "Dictionary of Zoology, Anthropology and Ethnology," pp. 346–351.

As an appendix to part third, we have the fifth installment of a series of elaborate reports upon the great anthropological museums in Germany. The title is as follows: V. Berlin. Das Anthropologische Material des Anatomischen Museums der Königlichen Universität. Erster Theil. Zusammengestellt von Dr. G. Broeseke, im Mai, 1880, pp. I–VIII, 1–87, closely printed. Correspondenz-Blatt, No. 12, 1880, and Nos. 1–2, 1881 close the volume.

BIBLIOGRAPHY:

BANDELIER, A. F.—1. Historical Introduction to studies among the sedentary Indians of New Mexico. 2. Report on the Ruins of Pecos. Papers of the Archæological Institute of America. Boston, A. Williams & Co., 1881. 1 vol., pp. 135, 11 plates.

CAMPBELL, PROF. J., M.A. (of Montreal)—Origin of the Aborigines of Canada. A paper read before the Lit. & Hist. Soc. of Quebec. Quebec, *Morning Chronicle*, 1881. Pamph., pp. 33–34.

DOUGLASS, S. J.—The Eskimo Race: its Origin, Migrations and Characteristics. *Good Company*, March–April, pp. 10.

FAILYER, PROF. G. H.—Traces of the Aborigines of Riley county, Kansas. *Tr. Kansas Acad. Sc.*, Vol. VII, 1879–80, p. 132.

INGERSOLL, E.—Personal Recollections of the Utes. *Good Company*, March–April, pp. 8.

MORSE, PROF. E. S.—Prehistoric Man in America. *Kansas City Rev.*, June, 1881, p. 90.

TYLOR, E. B.—Anthropology: an Introduction to the Study of Man and Civilization. N. York, D. Appleton & Co. 1 vol., pp. 448, 78 illus., 12mo.

VERNEAU, D. R.—The Black Races of Oceanica. *Pop. Sc. Month.*, April, pp. 9.

GEOGRAPHY AND TRAVELS.[1]

GEOGRAPHICAL NEWS.—A meeting of representatives of all the German geographical societies, was held at the rooms of the Berlin Society, on the 7th and 8th of June last. Dr. Nachtigal, President of the latter society, was in the chair. In his opening speech Dr. Nachtigal gave some account of the efforts made to form a union of the various geographical societies of the Empire. They include now about 4000 members. A plan of coöperation under the control of an executive body at Berlin, and including the publication of a journal, had been proposed, but met with too much opposition, and was therefore abandoned. Annual meetings for the reading of papers and discussions, was all that could be decided upon at present. At this meeting papers were presented, 1. On the Ways and Means of investigating the condition of the Earth's Center, by Professor Zöppritz [Professor of Geography at the University of Königsberg]; 2. On the Bermudas and their Coral Reefs, by Professor Rein [Professor of Geography at the University of Marburg], founded on observations made by the author during a two years' residence on the islands; 3 On the importance of Magnetic Researches, from the point of view of geography and the study of the earth generally, by Dr. Neumayer [Director of the Imperial German Marine Observatory at Hamburg]; 4. On the Claims of Ethnography, by Dr. Bastian [Director of the Ethnographical Museum at Berlin]; 5. On the Forms of German Houses viewed geographically and historically, by Professor Meitzen [Professor of Statistics at the University of Berlin]; 6. On the Results of earlier Travels with regard to the Botany of Tripoli and the Libyan Desert, by Professor Ascherson [Professor of Botany at the University of Berlin]. An animated discussion on the subject of geographical teaching in the schools took place, leading to the adoption of the following resolutions: "That a combination of geographical with historical instruction led to the injury and neglect of all school teaching; that even if geography is viewed as the only subject which connects physical science and mathematics with history, it should be joined with physical science in the instruction of the upper classes of schools; and lastly, that geography in the Government examinations of teachers, should be admitted as a separate science, and also as an accessory subject assisting to an important degree various other branches of learning." Professor Wagner, of Göttingen, advocated the sketching of maps, and especially the rapid delineation

[1] Edited by ELLIS H. YARNALL, Philadelphia.

of the main features of a country, its ranges of mountains, rivers, etc., as the chief aids in the study of geography, which ought, therefore, to be under the charge of the physical and mathematical teachers, whose sense of form and skill in drawing was far better developed than in teachers of philological and historical subjects.——Dr. Neis, a surgeon in the French navy, has recently made a journey in Indo-China, and discovered the source of the Dong-nai River in 12° 30′ N. lat., 108° 25′ 15″ E. long.——In describing Dr. Heath's recent discoveries on the Beni, as mentioned in the NATURALIST for June, the Proceedings of the Royal Geographical Society says: "As Dr. Heath claims to have been the first white man to see the mouth of the Madre de Dios, it may be interesting to remind our readers that in a paper[1] read before the society on February 25, 1867, our honorary corresponding member, Professor Raimondi, informed us that in March, 1861, Don Faustino Maldonado, of Tarapoto, in Peru, with seven companions, had descended the Madre de Dios into the Mamoré, and that though the leader and three others were drowned in the dangerous rapids called the Calderao do Inferno, the remainder continued the voyage down the Madeira into the Amazon."——A correspondent of the London *Athenæum* has discovered in a copy of the Lyons edition of the "Cosmographia" of Hylacomylus, published in 1514, a map which is the earliest known upon which the name America appears. The new world is represented by a large island in the "Oceanus Occidental," and across it is engraved "America noviter reperta." Heretofore it has been supposed that the most ancient map on which the name appears is the "Typus Orbis," printed at Vienna in 1520.

MICROSCOPY.[2]

MICROGRAPHIC TRACINGS.—In many physiological tracings it has been thought that some of the curves supposed to be of significance may possibly have been the result of oscillations of the lever. It seemed, therefore, to M. Marey, desirable to remove this doubt, and to demonstrate the fidelity of the instruments by showing that identical tracings may be obtained by other instruments which cannot be affected by this cause. This result has been attained by making the scale of record extremely small. If, for instance, the tracings of a sphygmograph are five (5) millimeters high, it is possible that the lever may, in its rapid movement, go too far before the friction arrests it. If, however, the amplitude of the movement is reduced to one-tenth ($\frac{1}{10}$), the effect of the momentum of the lever will be reduced to one-hundredth ($\frac{1}{100}$, the square root) of that which it possessed in the former case. But in order to preserve the form of the trace, the surface on which the lever writes must move very slowly, not more than one (1) millimeter per second. The details of the

[1] R. G. S. Journal, Vol. XXXVII, p. 137.

[2] This department is edited by Dr. R. H. WARD, Troy, N. Y.

curves thus obtained, will not be visible to the naked eye, but if placed under a microscope and magnified twenty (20) diameters, their form can be plainly seen. This method of record has another advantage. Donders has remarked that a recording apparatus is only accurate for movements of a certain rapidity, for which it has been constructed, and if it is made to record movements of much greater rapidity, they are not accurately represented. But the microscopic inscription multiplies almost indefinitely the field of work for the graphic method, by obtaining a sufficiently fine steel point to write, and a black layer thin enough to receive the tracing. M. Marey has already succeeded in receiving and registering the movement of a tuning fork vibrating two hundred (200) times per second, and in recording the vibrations of a voice singing at one end of a tube. Even the vibrations of blood in a vessel, which causes the "bruit de souffle," seem to be among the movements which can be recorded. At least, in the case of elastic tubes and artificial aneurisms, M. Marey has succeeded in recording the vibrations produced by a current of water, and which are also audible. A possible source of error in this method, which must not be overlooked, is the friction of the style against the glass. Momentum and friction are two sources of possible error in all tracings. The former augments with every increase in the range of movement of the lever, the latter with every decrease; and special care will be necessary to reduce the friction to a minimum to avoid this error.—*London Lancet.*

Sea Mosses.—A charming book on this subject, by Rev. A. B. Hervey, a prominent and skillful microscopist, just published by S. E. Cassino, of Boston, will be of the greatest value to microscopical students. Those accustomed to the study of the Algæ, will find it most convenient for determining species; while to all it is full of useful hints as to the character, location and preservation of these attractive objects. The many illustrations are printed in life-like colors, while the text is so arranged that the exquisite sea weeds of our coast, hitherto determined with difficulty, may be analyzed almost as easily as the wayside plants.

Angular Aperture.—The note on this subject, by Mr. Frank Crisp, Secretary of the Royal Microscopical Society, occupies about sixty pages of the journal of the society, and is probably the most elaborate editorial on microscopy ever published. It treats of the theory of microscopical aperture, vision and resolution in a most thorough and systematic manner, utilizing a vast amount of material acquired in correspondence with Professor E. Abbe, of Jena, to whom we are indebted for the first and only rational solution of this complicated problem. Taken in connection with recent papers by Professor Abbe himself, the modern doctrine of wide-angled objectives and resolving power is now for the first time fairly within reach of English readers.

SCIENTIFIC NEWS.

— At a recent meeting of the Anthropological Institute of London, Gen. Pitts Rivers read a paper on the discovery of flint implements in the gravel of the Nile valley, near Thebes. The worked flints were found imbedded two or three meters deep in stratified gravel. From this it appears that the evidence of human workmanship has been found in gravel deposits which had become so indurated that the ancient Egyptians were able to cut flat-topped tombs in it, supported by square pillars of gravel, which have retained their form uninjured to the present day, proving an enormously greater age for the flints imbedded in the gravel, some of which were chiseled out of the sides of the tombs.

— Apropos of the sittings of the Concord School of Philosophers, the same newspaper reports the proceedings of a "chinch-bug convention" in Kansas. It was stoutly maintained by the Philosophers of the Granger School, that chinch-bugs had long been an infliction to farmers; but no one called them such names as one or two of the Concord philosophers bandy about; and we should much prefer being a chinch-bug, luxuriating in the open air, than like a venerable transcendentalist's "soul," to be pent up as if a mere Cysticercus in some one's "occiput."

— Two eminent botanists have recently died: Dr. L. Rabenhorst, of Meissen (Saxony) was a well-known botanist and editor of *Hedwigia*. Among his numerous works was one on the fresh-water diatoms of Germany. Dr. M. J. Schleiden, a prolific writer, and author of "Die Planze" and "Das Meer," died at Frankfort, aged 77 years.

— The fresh-water jelly fish (Limnocodium) has reappeared in the Victoria Regia tank in the Botanical Gardens. Another writer in *Nature* speaks of sea anemones (Actinia) as living and flourishing in a fresh-water aquarium; no particulars are given as to the length of time, etc.

— The first part of a fourth edition of Griffith and Henfrey's Micrographic Dictionary has appeared. It is expected to be completed in twenty-one monthly parts.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

NATURAL HISTORY SOCIETY OF ILLINOIS, June 12.—According to programme the members met at the Palmer House, where several new names were added to the list and some other business was transacted, among which was the organization of the entomologists into a separate section, with C. E. Worthington as president and G. H. French, secretary. The meeting in Chicago numbered about thirty, somewhat smaller than the Ottowa meeting, but that may be accounted for, perhaps, by the fact that the proposed place for the field meeting did not afford so good an opportunity for geologists, and hence they were out in smaller numbers.

On the morning of the 13th the society went by the Mich. Southern R. R., to Whitings, Ind., and from there about a mile and a half to the grounds of the Lake George Sporting Association, the proposed place of rendezvous. This is a tract of wild land containing two or more lakes, low meadow and marsh lands and ridges of timber, in all several thousand acres. A few miles out from here is a belt of pines, the whole giving an exceedingly rich and varied flora and fauna in which all kinds of scientific specialists might find something of interest. The departments of natural history were represented in the field during the week by the following persons:

Geology—Tyler McWhorter, Aledo; L. E. Evans, Streator; Edgar L. Larkin, New Windsor.

Ornithology—J. L. Skelton, Chicago; B. P. Colton, Princeton; Geo. S. White, Lake View.

Ichthyology—Professor S. A. Forbes, Normal; W. H. Garman, Normal; Professor Joshua Lindahl, Rock Island; Frank L. Rice, Evanston; N. S. Davis, Jr., Evanston. The two last also collected Crustacea.

Entomology — C. E. Worthington, Chicago; G. H. French, Carbondale; Dr. E. H. Boardman, Elmira; F. M. Webster, Waterman; W. H. Bridges, Elgin; H. Darlington, Chicago; H. A. Peters, Rock Island. Dr. Boardman and Mr. Bridges worked part of the time in botany.

Botany—Professor E. J. Hill, Englewood; Professor T. J. Burrill, Champaign; Cyrus Kehr, Sterling; Ewing Summers, Chicago; W. J. Stevens, Morris.

There were a number of others at the Chicago meeting, the above list including only those who went out to Lake George.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

American Journal of Science, August.—Geological relations of the limestone belts of Westchester county, New York; Origin of the rocks of the Cortlandt series, by J. D. Dana. Nature of Dictyophyton, by R. P. Whitfield.

Nature, June 2.—A chapter in the history of the Coniferæ. The Cupressineæ.

June 16.—Dr. Miklucho Maclay's Anthropological and Anatomical researches in Melanesia and Australia.

July 7.—Civilization and barbarism in South Africa.

July 14.—British Museum Catalogue of Birds.

Geological Magazine, July.—Two new British Carboniferous insects, by S. H. Scudder. On Vogt's View of the Archæopteryx, by H. G. Seeley. Sudden extinction of the Mammoth, by H. H. Howorth. The Vertebrata of the Forest Bed series of the east of England, by E. T. Newton. Correlation of the Lower Palæozoic rocks of Britain and Scandinavia, by C. Lapworth.